CHANGING TIMES AND CHANGING WAYS:

LOCAL KNOWLEDGE, POLITICAL ECOLOGY AND DEVELOPMENT IN THE NIGER RIVER INLAND DELTA OF CENTRAL MALI

by

TODD CRANE

(Under the direction of Robert Rhoades)

ABSTRACT

Ethnopedology, the study of local knowledge of soils, is moving beyond descriptive soil typologies to include knowledge of ecological processes of soil management and land tenure customs, as well as historical and political factors that influence land management. The Marka and the Fulani ethnicities have both inhabited central Mali for centuries, but they have occupied distinct subsistence niches: the Marka as farmers and the Fulani as cattle herders. Despite living in the same region, Marka and Fulani maintain distinct cognitive models of the environment and their places in it. Although their soil nomenclatural systems both use consistency and color as primary and secondary markers respectively, their actual classifications vary. This variation is explained by their different historical subsistence strategies.

In recent decades, the Marka and the Fulani subsistence strategies have begun to converge into agropastoralism. Although their economic behaviors have become more similar, their ideologies about land management and their perspectives on land-use conflicts continue to be at odds. This is attributed to the maintenance of ethnic identities

that are closely linked to subsistence behaviors, especially for the Fulani. Ideologies linking specific subsistence strategies with ethnic identity can affect decision-making and political positioning even when actors do not have a direct material interest in that particular subsistence strategy. Consequently, exertions and counter-exertions of power between farmers and herders, at the individual, local and national levels, reflect competition over control of land resources by user-groups with ethnically linked land-use interests. This competition over land-use has been reflected in historical power relations between user groups in the region, especially starting from the rise of the Dina in the 19th century. Both ethnicities perceive their environment from vantage points that are significantly shaped by their ethnic identities, which are in turn the result of the particular subsistence niches, political history and cultural values. These same factors influence their land management and political strategies in regards to rural development.

INDEX WORDS: Africa, Mali, ethnoecology, ethnopedology, local knowledge, Fulani, Marka, agriculture, pastoralism, development, identity, political ecology, ethnic conflict, historical ecology

CHANGING TIMES AND CHANGING WAYS:

LOCAL KNOWLEDGE, POLITICAL ECOLOGY AND DEVELOPMENT IN

THE NIGER RIVER INLAND DELTA OF CENTRAL MALI

by

TODD A. CRANE
B.A., Indiana University, 1994

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA
2006

CHANGING TIMES AND CHANGING WAYS:

LOCAL KNOWLEDGE, POLITICAL ECOLOGY AND DEVELOPMENT IN

THE NIGER RIVER INLAND DELTA OF CENTRAL MALI

by

TODD A. CRANE
B.A., Indiana University, 1994

Major Professor: Robert Rhoades

Committee: J. Peter Brosius
Virginia Nazarea

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
August 2006

ACKNOWLEDGEMENTS

To tweak a common expression, “It takes a whole village to raise an anthropologist”. In my case it took even more than that. This dissertation would not have been possible without the generous support, assistance, and encouragement by the following individuals and institutions. All of them played a part in the creation of this document. *U bɛɛ sen b’a la.*

My advisor, Robert Rhoades, and committee members, Virginia Nazarea, Pete Brosius

Sustainable Agriculture and Natural Resource Management team members:
US – Keith Moore, Carlos Perez, Carla Roncoli, Oumar Badini, Ozzie Abaye, Christine Jost, Meriem El Hadj, Jeff Goebel
Mali – Amadou Kodio, Salmana Cissé, Boureima Traoré, Karim Ouatara, Moussa Keita

The Natural Resource Management Advisory Committee of Madiama

The Madiama Communal Council

People of the Commune of Madiama

Ibrahim Diallo

Issa Kané and Albadia Touré

Augustin Témé

Karim Traoré and Sekou Camara – for getting me started in the rich language of Bambara.

Summer Cooperative African Languages Institute

UGA Anthropology Department Staff – especially Labau Bryan, Margie Floyd, Charlotte Blume, Arnold Brunson, Lisa Norris

The Flying Rats, The Malemen, Tepooka Two, and The Deryls

My parents and in laws – for support all along the way, and for looking after the cats

Sarah Hunt – for more things than could possibly be listed

LINGUISTIC NOTES

Over the course of the last several decades, linguists have developed standardized orthographies for both Bambara and Fulfulde (the language spoken by people of the Fulani ethnicity). Across West Africa, literacy programs in national languages have simultaneously become more prevalent. When spelling out Bambara and Fulfulde words, I have opted to use the contemporary orthographies of those languages, which involve a few characters not found in the Cyrillic alphabet. Below is a brief guide to these unfamiliar characters.

At times this practice may be confusing, as there is already literature, especially Francophone literature, that uses a Francofied spelling. For example, when I refer to a *joro*, the Francophone literature, and hence much Anglophone literature as well, writes *dioro*. Where Cyrillic spelling would write *nyamaku*, I instead use the orthography for national languages which spells it *ɲamaku*. With the exception of some place names, I have chosen to use this orthography out of respect for the languages that use it, and to promote, or at least support, increased literacy in African national languages.

As these characters do not exist in standard font packages, everywhere they occur in this dissertation, they are in the font Gentium, which was designed to be universal linguistic font, covering all orthographies (outside of character-based, Asian languages). This font is available for free download from the Summer Institute of Linguistics website.

Found only in Bambara

ɛ = e with guttural stop (no capital)

ɔ = o with guttural stop (no capital)

Found only in Fulfulde

Ɓ	ɓ	=	implosive b
Ɗ	ɗ	=	implosive d
	ƴ	=	y with a guttural stop (no need for capital version in Fulfulde)

Found in both Bambara and Fulfulde

Ŋ	ŋ	=	ng
Ɲ	ɲ	=	ny

In both Bambara and Fulfulde, the letter "C" is pronounced like a hard "ch", as in "chocolate".

ACRONYMS

BCEAO	–	Banc Central des Etats Africains de la Ouest (Central Bank of West African Nations)
IER	–	Institut d'Economie Rurale (Institute of Rural Economy)
HM	–	Holistic Management®
PLLA	–	Participatory Landscape/Lifescape Appraisal
LAM	–	Les Amis de Madiama (The Friends of Madiama)
NRID	–	Niger River Inland Delta
NRMAC	–	Natural Resource Managament Advisory Committee
SAM	–	Social Accounting Matrix
SANREM	–	Sustainable Agriculture and Natural Resource Management.
US-AID	–	United States Agency for International Development

TABLE OF CONTENTS

PAGE

TABLES AND FIGURES

CHAPTER 1

PROBLEM STATEMENT

I first arrived in Mali as an agricultural anthropologist looking to study local ecological knowledge held by farmers. However, I quickly learned that an anthropologist cannot study agricultural in central Mali without studying pastoralism. The two are so intertwined that I would have been negligent to work on agriculture without incorporating pastoralism too. Pastoralism is directly relevant to agricultural management because with the reduction of fallowing due to land shortage, access to animal manure has become an essential aspect of agricultural production. Similarly, pastoralists have long relied on farmers' grains and their herds have browsed harvested fields for centuries. Furthermore, changing times have caused farmers to integrate animal husbandry into their production strategies and herders to integrate cultivation into their production strategies.

The incorporation of pastoralism in my research has not been without its difficulties. Pastoralism introduces a whole new set of linguistic and cultural variables into the mix. It essentially calls for the vast broadening of the system toward which I was pointing my anthropological gaze. The relationship between agriculture and pastoralism in central Mali is often contentious and competitive, requiring me to expand my topic from a focus on technical ecological knowledge to include ecological relations between agriculture and pastoralism, as well as complex social relations between the farmers and herders. These relationships are complex, including both synergistic and adversarial aspects. As such, I found that in addressing local knowledge of agriculture and pastoralism in Mali, it was important to move beyond

technical knowledge and into knowledge of the social contexts in which local technical knowledge is situated. These social contexts include, but are certainly not limited to, cultural ideologies, political regimes, and access to material resources and power. In short, by situating local knowledge in the broader framework of farmer-herder relations, I seek to integrate ethnoecological knowledge systems with political ecological strategies.

Cultural Ecology of the Niger River Inland Delta

The social geography of central Mali includes numerous ethnic groups that have historically played distinct roles in the regional cultural ecology of the Niger River Inland Delta (NRID henceforth). Bozos are fishermen, boatmen and rice farmers[1], Marka are farmers and merchants, Fulani are cattle herders and religious scholars, Bobos are upland farmers and renowned hunters. Based in the northern part of the Delta, around Timbuktu, Songhay are merchants and farmers and the Tuareg are dominant as herders of camels, donkeys and cows, as well as the primary conductors of the trans-Saharan trade in its day. I want to emphasize the historicity of these subsistence niches because in recent times, particularly the last 50 years, there has been much blurring and weakening of the links between ethnicity and subsistence strategies.

I realize that these characterizations may be critiqued as being gross essentialisms, but I have found that they are essentialisms that are grounded in an historical reality, and perhaps more importantly, despite some breakdown, they are very much alive in the folk knowledge of Mali. They form a sort of "ethnoessentialism" that can be seen as part of a construct of ethnic identity and ethnic difference. As with any generalities, there mostly certainly are cases where people have broken out of these broad characterizations, but they still form an important frame of reference when attempting to understand the social ecology of the NRID from a local perspective. Through the course of my dissertation (see especially Chapter 6), I will examine

[1] Bosos, or their cultural ancestors, are locally believed to be the earliest occupants of the Delta.

how these links are still alive in people's behaviors, memories and constructs of ethnic identity, even if their actual productive behaviors sometimes belie these idealized lifeways.

Like in Barth's classic study in Pakistan (Barth 1956), which introduced the concept of ecological niche to anthropology, each ethnic group in the NRID region has historically occupied a distinct subsistence niche in the regional cultural ecology. While each of these ethnic groups has its own distinct language, history, cultural identity, and historical ecological niche, their productive geographies, or "action spaces" (Painter, et al. 1994), overlap considerably. In the southern part of the Delta, the overlap of production systems is especially true for the transhumant Fulani herders, who come from all over West Africa to spend the dry season in the Delta, and the rainy season in "highland" pastures from Senegal to Niger. The action space of fishermen also overlaps with other land-uses, as fishing grounds overlap with rice fields, and cattle trails and pastures.

Farmers, especially those at the edge of the floodplain, exploit upland and lowland fields that are often far from their home villages and butt up against pastures and fishing grounds. When commerce and seasonal migratory labor is factored in, farmers' action space can be seen to expand yet more. Of course, this is not a timeless pattern. As will be discussed in greater depth in Chapter 3, the earliest permanent settlements in the southern Delta region have been dated the 2nd century BC and the Fulani began arriving in the southern NRID area with their cattle herds around the 12th century AD. Ethnic relations and the organization of ecological exploitation has undergone, and continues to undergo, important transformations.

Unfortunately, one of those transformations is tied to declining average annual rainfall. Since the 1950's, average annual rainfall in Mali has plummeted to two thirds of its previous

averages, which were already low[2]. Not only does this affect rain-fed agriculture crops, but it also means that the river does not flood as reliably or as large an area as it once did. Loss of soil fertility is associated with declining precipitation combined with increasing demographic pressure, as fallows are used less and reduced rainfall means reduced biological productivity.

At the kickoff of SANREM in Madiama, researchers conducted a Participatory Landscape/Lifescape Appraisal (PLLA) to determine the most important problems and issues facing the residents of Madiama. Unfortunately, I was not yet involved in SANREM, so did not participate in this stage of the process. Declining soil fertility ranked high among local concerns, along with farmer-herder conflicts and inadequate pasture for animals (Earl and Kodio 2005). The fact that community representatives identified declining soil quality as a primary concern that they wanted to address, oriented me toward ethnopedology, the study of local knowledge of soils, as a starting point for my research. I found along the way that maintaining soil fertility under an intensifying management regime is primarily a function of access to animal manure, the primary resource for maintaining soil fertility. As such, the study of access to manure was a natural outgrowth of my ethnopedological research. This train of thought quickly led me to include farmer-herder relations.

Culture, cognition and adaptation

The notion that the cultural ecology of the NRID has evolved in such as way that subsistence niches are occupied by ethnically-identified user-groups, addresses the topic of behavioral adaptation. This is a point which is easily visible and widely recognized in the history of the NRID. But how have the behavioral adaptations to specific subsistence niches affected ideological development among those ethnic groups? Do they cognize the environment

[2] Average annual rainfall in Madiama today is around 600mm per year.

differently in correspondence with their different behaviors and resource-use patterns? In a review of pastoralism literature, Dyson-Hudson and Dyson-Hudson observe that most research

> … makes it clear that a knowledge of features of the natural environment is not sufficient for understanding the behavior of pastoral nomads. The features of the material world which help to organize the behavior and social organization of nomadic pastoralists include not only edaphic factors in the natural environment, but also complex social relationships at many levels (Dyson-Hudson and Dyson-Hudson 1980:50-51)

Ecological exigencies alone cannot explain production behaviors. They are also shaped by the social history and milieu in which have developed. A more recent review of pastoralism literature finds that development policies, sedentarization, and increased adoption of agriculture are influencing the ecology of herding behaviors (Fratkin 1997). Looking beyond the ecological aspects of subsistence adaptations, it is also important to examine the ways that subsistence activities are intertwined with cognition of the environment itself, ideologies of ethnic identy, and social history.

All ethnic groups in the NRID act within and share the same, or at least an overlapping, environment. But while they all occupy the same geographic environment, do they share the same mental image of that environment? Do they see that environment through the same cultural lens or are their ideologies impacted by their distinct histories within and exploitation of that environment? Examining a similar scenario in a very different environment, Bennett (Bennett 1969) found that ranchers, farmers, Native Americans and Hutterites in Saskatchewan all maintained distinct production strategies despite operating within the same northern plains environment. Where Bennett focused on social organization and technological adaptation, I will focus instead on ideological aspects of cultural adaption.

While cognitive capacities are uniform across the human species, the details contained therein are culturally contingent. The particular history, broadly construed, of a cultural group will affect the information, both technical and ideological, that is passed down within it. To draw

on Rappaport's terms, people behave within the "operational model" of reality, which is to say the materialist reality of a mechanistic universe. This is the reality that most Western science seeks to describe. Although people act within the operational model of reality, their behavior is guided by their "cognized model", the mental constructs through which human minds, and collectively human cultures, grasp operational reality (Rappaport 1979).

In discussing the liturgical order used Maring in ritual cycles, Rappaport identifies 5 levels of cognized models that exist in a nested hierarchy. At the top level are "ultimate sacred postulates" which "are not material and are beyond the reach of logical refutation, are neither verifiable nor falsifiable, but are nevertheless taken to be unquestionable" (Rappaport 1979:117). The second level, which is closely associated with the first are cosmological axioms, which address "the fundamental structure of the universe or . . . paradigmatic relationships in accordance with which the cosmos is constructed" (Rappaport 1979:118). Rappaport emphasizes that cosmological axioms are not what we would call "values", but are the ideological basis from which values are derived and upon which they are justified. Values may change without changing the cosmological axioms.

Rappaport does not provide a gloss term for his third level of cognized models, but I find "cultural values" to work well. Cultural values represent the ways in which cosmological axioms are transformed into behavior. For example, differences between men and women might be a cosmological axiom in many cultures, but the specific ways that that difference is manifested and is given meaning vary widely across cultures. Pointing out that the first three levels of cognitive models emphasize the export of ideological constructs to place order on the world. The fourth level reverses that, importing information from the material condition of the world and incorporating it into ideological structures where it can be given meaning and can provide

feedback to guide responses to the material reality. Rappaport shows at this level that found adaptive feedback loops embedded in the ritual cycles among the Maring (Rappaport 1979).

> Finally, the fifth level of cognitive models incorporates mundane knowledge which is more or less completely external to the liturgical order but investing domains over which the liturgical order ultimately presides. I refer here to secular understandings of the everyday world, its people, its animals, its plants, its places, its activities. It is on this 'level' (surely more complex than the notion of a single level suggests) that classification seems to be most highly elaborated (Rappaport 1979:121).

Rappaport's interests focus largely on ritual aspects of cognitive models, the higher orders of his hierarchy. Unfortunately, he does not say anything more about this fifth and mundane level of cognitive models. It is clear from his description, however, that ethnoecological research resides in this level of Rappaport's scheme of cognitive models.

It is important to note that Rappaport says cognitive constructs at any level can change without changing the levels above it. For example, someone might learn about a new plant or new qualities of a plant, but that need not change a belief that plants are connected to the spiritual world. Cultural values can change, through time or through space, without altering cosmological axioms. The incorporation and responses to external stimuli can change without altering cultural values, and mundane knowledge can change without altering the ways that external stimuli are incorporated and responded to. This is a way of saying that a single set of cosmological axioms can contain more than one set of cultural values. Likewise, a single set of cultural values can contain numerous sets of adaptive ideologies and ethnoecological systems.

Farmers and herders in central Mali play different roles in the operational model of the regional ecology. The social ecology of the NRID is comparable to the Swat area of Pakistan, where Barth documented three different ethnic groups who occupied different subsistence niches in a single ecological zone. In central Mali, the ethnic groups who are often historically associated with specific subsistence strategies fill specific niches in the operational model of

regional ecology. The apparent ecological functionalism in this characterization should not serve to mask centuries of complex history and power relations in the area. Instead, it should underscore the close ties between ethnic identity and socioecological niche. I will examine the social history of the West Africa and the NRID in Chapter 3, and then focus on social institutions and historical power relations as they pertain specifically to land tenure in Chapter 5.

"All cognized models encode values, but all do not value the same things equally, and we may inquire into the adaptiveness of different sets of evaluative understandings" (Rappaport 1979:101). Because of the close ties between ethnic identity and subsistence strategies, I approach my research with the conceptual hypothesis[3] that ethnic groups will hold different cognized models of the regional ecology, models that differently value or emphasize the importance of certain aspects of the overall system. While Rappaport was primarily interested in the links between ritual behavior, ideologies and long-term adaptiveness embedded in cognized models, my intents with this research do not extend that far. I seek to examine two cognized models of the same environment, that of the Marka (traditionally farmers) and that of the Fulani (traditionally herders), in order to identify the values encoded therein[4]. Chapter 6 will elaborate Marka and Fulani local knowledge systems of soils, addressing Rappaport's fifth level of mundane knowledge and fourth level of adaptive management processes. In Chapter 7, I will go on to compare broader cultural values, Rappaport's third level, particularly those that relate to ethnic identity and subsistence strategies.

[3] I do not see this dissertation as having a strict hypothesis testing structure, but I still find it conceptually useful to approach the subject with a general hypothesis in mind.

[4] The simple characterization of Markas as farmers and Fulani as herders is admittedly problematic, as in reality both are usually agropastoralists at present, practicing a mixed farming-herding subsistence strategy. The labels I use to distinguish the two are the result of their own self-identification practices, that I have simply adopted. A rural Fulani with several fields but without a single goat to his name will usually identify his profession as "herder". Alternatively, a rural Marka that owns a large herd of cows (invariably herded by a hired Fulani) will identify his profession as "farmer". It should be noted that this professional identity is reified in national identification cards, which require people to state their professions. In short, the labels "farmer" and "herder" used here, and throughout my dissertation make reference more to self-identification rather than actual mode of subsistence.

Rappaport's notion of cognized models has been further developed by some ethnoecologists to analyze how decision-making varies across and within cultures. Nazarea (1995) has developed the idea of situated knowledge, looking at how qualitative aspects of knowledge systems can be contingent upon not only upon culture, but also upon one's position within a culture *vis a vis* gender and socioeconomic status. Drawing directly from Rappaport, Nazarea uses a cognized models framework to compare men's and women's ecological knowledge, elucidating variation in their approaches to agricultural decision-making according to their positions in a particular time and place, their position in history and culture.

> While the operational reality provides the context and even, perhaps, sets the boundaries for decision making, the cognized model defines the indigenous decision-making criteria, available categories of choice (or percieved options) . . . and people's response to opportunities and constraints posed by the operational reality (Nazarea-Sandoval 1995:14).

The integration of cognized models with ethnoecological research is closely linked to the utilitarian hypothesis of cognition (Hunn 1982), which proposes that the mental constructs of the environment can be influenced by one's utilitarian relationship with it. The utilitarian hypothesis stands in contrast to the notion that cognition of the environment is based primarily on readily perceptible features that are universally salient (Berlin 1992; Berlin, et al. 1973; Boster 1996). Combining the ideas of Rappaport and Hunn leads to the proposal that not only do different user-groups, or stakeholders, have different economic interests in relation to a single environment, but they can have entirely different ideologies about what that environment is, what their relationship to it is and what it means to them. This theme will run through Chapters 6, 7 and 8, which address local knowledge of soils, ethnic identity, and land-use conflicts respectively,

I came across an example of differing cognized models of the same operational reality while conducting my pilot study. It was this example that initially moved my research in this direction. I asked a Marka farmer for his explanation for diminishing soil fertility, and he told me

“There are not enough cattle and so not enough manure for the fields”. Posing the same question to a Fulani herder, he explained that “There are too many fields for the number of cattle”. Both informants were describing the relationship between agroecological variables: agricultural fields and their need for manure, but their responses reveal different values. The Marka gave primacy to fields and the Fulani gave primacy to cattle. This would not surprise any Malian, nor would they even find it interesting. It is simply so obvious as to not be noteworthy.

The subtle differences in the responses of these two informants illustrates what agroecological factors they see as constants and what they see as variables. For the Marka, the number and size of fields were constructed as a given part of the equation, whose needs the variable of manure can fall short of, meet, or surpass. Conversely, the Fulani portrayed the number cattle as a given and the number of fields as out of balance with it. This example illustrates that cognition of the environment occurs at a number of levels, which can range from characterizations of organisms and soils up to landscape level socioecological processes.

Though Marka and Fulani act within the same operational model, their cognized models encode different values that are linked to their positions within the agroecological system. In Chapter 7 and 8, I will make the case that these value-encoded cognized models guide adaptive strategies, both in terms of behavioral ecology of economic production and political maneuvering on issues of natural resource management. Economic interests may drive adaptive strategy, but cultural values impact the perceived adaptive options within a changing environment that demands a response.

In a rapidly changing environment, adaptive strategies, which is to say the behavioral choices, play a crucial part in determining the success of the actors as well as the long-term stability of the entire system. In recent decades, Mali has been undergoing major and rapid

changes in the ecological, political, demographic and technological environments. The rapidity and degree of change makes choices on adaptive strategy in this dynamic, and, many would say, degrading environment, especially important. The fact that central Mali is a multi-ethnic, multi-use landscape with increasing competition for increasingly scarce land and water resources makes choices of adaptive strategies all the more important. Under these circumstances, adaptive strategies not only impact ecological sustainability and the success of the actors, but they can also serve to intensify or reduce conflicts and competition between user-groups, depending on the behavioral and political strategies employed.

The Fulani and the Marka, among other ethnicities, share increasingly overlapping action spaces in which they live and make a living. My overarching research question is "In what ways do the Fulani and the Marka share an overlapping cognized model of the environment and in what ways do their cognized models of the environment differ"? Following that, I am interested in looking at how the values encoded in the worldviews shape their perceptions of their options for adaptation to the rapid changes that are currently occurring in Mali and the West African region in general.

The first step in addressing this question is to describe the ecological knowledge systems of Marka and Fulani. This will be done through a data collected in an ethnoecological survey focusing on knowledge of soils and cattle fodder. The results of this part of my research will describe local knowledge of soil types, soil management, preferred fodder for domesticated animals (cows, goats, sheep) agroecological processes and functions. Also included in the ethnoecological survey, were questions about the causes of farmer-herder conflicts and opinions about how they can be reduced. Analysis of these data reveals folk conceptualizations of

socioecological processes from the micro to the landscape level, providing an integrated view of local agroecological knowledge.

Having described the two local knowledge systems, my second objective is to compare them in an effort to explicate some of the ways in which the Marka and Fulani differently cognize their physical environments. Do they categorize soils using different perceptual feature? Do they parse them out in the same degree of detail? How do their perspectives on soil management differ? To what degree do they agree on the causes and possible solutions for farmer-herder conflicts? This comparison bears directly on questions of development policy

The Marka and the Fulani have had significantly different subsistence strategies for all of known history. As such, their utilitarian demands on the environment are also different. The Marka, as farmers, have had more experience cultivating soil and growing crops, while the Fulani, as pastoralists, have more experience transhuming with their herds across pastures, giving them more experience with animals and fodder species of trees and grasses[5]. The utilitarian hypothesis would predict that their cognitive constructions of the environment should differ according to their mode of exploitation, even though they live and produce in an overlapping, though not entirely the same, environment.

The ethnobiological debates between Hunn, Berlin and others were often in reference to a fairly narrow interpretation of what constituted folk ecological knowledge, focusing largely on taxonomic representations of categorical knowledge. Expanding on the field, I construe local knowledge very broadly in comparison to much previous literature on the subject. Although I start with technical ecological knowledge, such as soil typologies, characterizations and management practices, my research follows a trend of branching out more broadly to examine

[5] Historically, the Fulani gained access to grain either through commercial exchange of milk or animals for grain, or through the acquisition of slaves whose task it was to grow grains for their owners.

other kinds of cultural knowledge that pertain to the social contexts of natural resource management and development (Ellis and West 2004; Nazarea 1998; Niemeijer and Mazzucato 2003; Sillitoe 1996). In my case, this includes, but is not limited to, knowledge of ecological functions and processes, social institutions and practices surrounding land tenure, local perspectives on natural resource conflicts and possibilities for their resolution, relationship between ideologies of ethnic identity and productions strategies, the relationships with changing regimes of political power, and responses to international development efforts. All of these are aspects of local knowledge that can, and I will argue have, impacted land management practices and overall adaptive strategies. In conjunction with traditional ethnoecological classification schema, they provide an ethnographic context that can make ethnopedological research more meaningful and relevant to local beneficiaries of development efforts.

CHAPTER 2

THEORETICAL BACKGROUND

Ethnoecological research in a development context involves interweaving several intellectual threads. It also requires the clarification of some problematic terms before proceeding with their use. In the first case, I would like to tease apart several terms that are often used synonymously. In the second case, I would like to blur the distinction between two terms that often used in contrast to each other. It bears pointing out that my discussion of local knowledge is implicitly limited to mundane, non-specialist knowledge. Specialist knowledge, particularly knowledge from which certain classes of people are systematically or institutionally excluded, is not addressed.

Local knowledge vs. indigenous knowledge

Searching ethnoecological literature is difficult because the topic is found under so many different monikers, each of which carries its own subtle distinctions. In joining ethnoecological literature, every writer needs to make well-considered choices from the beginning about their choice of labels.

> There has been much discussion elsewhere of what the most appropriate term might be to label that knowledge upon which this volume focuses: ethnoscience, folk science, citizen science, traditional knowledge, local knowledge, indigenous knowledge (IK), traditional environmental knowledge (TEK), indigenous environmental knowledge (IEK), traditional knowledge systems (TKS), or even 'cunning intelligence'. . . . Each term has been generated in a particular discourse and nexus of social and professional interactions, none are homogeneous, and all have their uses, come with slightly different connotations (although many with a surprising degree of semantic overlap, and carry particular ideological and moral loads. All have their advantages and disadvantages. What term we use is in part a question of whether that term has become part of a particular local, sectoral, professional or national policy context, and in which specific debates it appears (Ellen 2002).

From among these options, I have chosen to use simply "local knowledge" as the overarching description of this type of work, or "ethno-" for specific subdisciplines. Over the last 20 years or so, "indigenous" has come to be a power word, used in a particular sense. Taken at a basic level, "indigenous" is a way of saying "local to a place". However, in both public and specialist discourse, the word "indigenous" is often paired with "rights" or "movement", and has been groomed to evoke the image of the ethnic subalterns, especially those who have maintained "traditional" (pre-colonial) lifeways, who have been politically, economically and linguistically persecuted or marginalized by the dominant, generally colonial, ethnic groups. "Indigenous" is typically employed to identify the struggles of the underclass "from-heres" (natives) against the hegemonic force of ruling class "come-heres" (colonials). This has been the case even, or perhaps particularly, in anthropology, which used to rely more on the labels "folk" or "ethno-".

> The shift from studying folk knowledge to studying knowledge systems was accompanied by adding *indigenous* to the term, making it *indigenous knowledge system*. The early use of this formulation, for instance in the volume Indigenous Knowledge Systems and Development (Brokensha, et al. 1980) built directly upon the massive literature on folk knowledge (e.g. Conklin, 1972). As originally used in cognitive and ecological anthropology, the term *indigenous* was used interchangeably with *folk* and glossed as 'local' or 'non-formal'. The term was used ambiguously, sometimes including local populations of majority groups. The common use of *folk* or *ethno-* by older generations of cognitive anthropologists conformed to the study of folk cultures in other subfields of the discipline. The principal opposition implied was between non-formal and Western scientific knowledge systems. . . . The more politicized reading of the term indigenous emerged after 1980, as anthropologists gave increasing emphasis to European domination and capitalists expansion. The current usage of indigenous is predicated on the opposition between nation-states and minority ethnic groups that have been dominated but no absorbed, implying notions of cultural and political resistance. Indigenous takes on a more essentialist tone and is glossed with autochthonous, native or aboriginal. The current use of indigenous is both sociological as descriptive and ideological as proscriptive, suggesting that minority ethnic groups should have more power and recognition (Brush 1993:659).

The genealogy of the label "indigenous" has continued in the politicized vein. By analyzing and distilling academic and activist discourses in journals devoted to indigenous themes, Purcell (1998) characterizes how "indigenous people" are defined by northern

specialists. He then goes on to succinctly summarize the place of indigeneity in the contemporary historical and political climate.

> Indigenous people are existing descendants of non-Western peoples who, in general, continue to occupy their ancestral lands even after conquest by Westerners, or who have been relocated forcibly in the process of colonization. Indigenous people maintain a cultural complex that sets them apart from the Western socio-cultural tradition. Indigenous people, therefore, stand in a historical relationship of conflict and asymmetry vis-à-vis Europeans in that the construction of capitalism was largely achieved through the exploitation of land, labor and symbolic resources previously controlled by non-Europeans. This definition takes into account two key historical/political factors. First, indigenous peoples' drive for self-determination which has contributed to the new emphasis on the application of non-Westerners; and emphasis on the application of non-Western knowledges; and second, the location of the process within a global historical conflict of domination and struggle and the challenge to Western cultural hegemony which inheres in that conflict (Purcell:260).

Purcell's analysis of the label indigenous applies equally well to concomitant and later works by Ramos (Ramos 1998), Warren (Warren 1998b; Warren and Jackson 2002) and Sawyer (Sawyer 2004). Illustrating that the label "indigenous" is intentionally used for political ends, Brosius (Brosius 1997) provides a southeast Asian case study in exploring how Penan hunter-gatherers and environmental activists employ the 'indigenous' label in an effort to bolster their joint defense of the rainforest, albeit for somewhat different motivations.

The label "indigenous" is often used to highlight and contrast ethnic differences as they relate to the history of Europe as a global power. Indigeneity has become the hallmark of political movements in Latin America, North America and southeast Asia where the ethnic contrasts between powerful and the subalterns are often very sharp. In short, indigenous has become a politicized term and is now laden with particular meanings and connotations.

In African contexts, use of the "indigenous" label for social movements is remarkably rare, considering the power it has gained in North and South America and Southeast Asia. The occasions on which it has been recently used, by the Massai in Tanzania (Hodgson 2002) and the San in southern Africa (Sylvain 2002), its application is consistent with Purcell's distillation of meaning as marginalized, ethnic underclass. It is noteworthy that

in both of the cases cited above, there is contention even within the communities about definitions, authenticity and goals of adopting the discourse of indigenous rights. The rarity of discourse on indigenous rights in African leads to questions of why it has not caught on there. In Africa, the label “indigenous” is problematic due to its use as a distinguisher between historically local subalterns and the more recently-arrived colonial ruling classes. With the exceptions of apartheid South Africa and possibly Liberia, the end of colonialism has brought about situations wherein the ruling classes and the ruled classes, the urban and the rural, are all indigenous, all from there. While there may still be disenfranchised ethnic underclasses, their indigeneity, which is to say their localness, is not what sets them apart from the ruling classes.

When examining colonialism, one must raise questions of the degree to which local ideologies have been overrun by or otherwise aligned with colonial authorities and their ideologies, and the degree to which ruling classes have adopted Western ways of knowing. As such, “indigenous knowledge” might still be a tenable contrast against Western (Northern) institutional knowledge, but only if one is willing and able to tease apart the origins and histories of specific ideas as they exist in knowledge systems. However, unless that is the specific objective of the research, I think such an undertaking would be of marginal utility or even feasibility, and I suspect hybrid systems would be the norm.

Even among ruling classes, who are often educated in a Western system, aspects of local knowledge are likely to be carried with them, complicating distinctions between indigenous and Western knowledge systems. However, one of my informants alluded to a sort of tension between indigenous and Western praxis among rulers in contemporary Mali. “National laws are written by the sons of peasants and the sons of herders who carry their

interests with them and make laws that they then have to enforce on their parents". To some degree or another, rulers carry their traditions, proclivities and biases, but also break tradition by imposing restrictions (laws) on their elders.

A secondary reason that I have chosen not to use "indigenous knowledge" is that I was told that in Francophone Africa, the label "indigenous" (*indigène* in French) carries strong negative connotations of backwardness and primitiveness. While the label has gained currency in the Spanish and English speaking worlds, it is politically incorrect in Francophone Africa. If I were to speak about *connaissance indigène* (indigenous knowledge) with colleagues in Mali, it would make me look like a patronizing racist. I learned this through the rich experience of participant observation among Malian researchers, who quickly corrected me. It is likely that the racist overtones of the label *indigène* in Francophone Africa contribute to its lack of currency there. The preferred term in Mali is *connaissance locale* (local knowledge) or *connaissance paysan* (peasant knowledge)[1].

Because of the political connotations attached to the label "indigenous", and the problem of authenticity, I have chosen to entirely avoid the use of the term "indigenous knowledge" to describe the topic of my research. I cannot come out against use of the phrase by other researchers, because it does have its utility in certain times and places, but I am not comfortable applying it to my specific research context. In contemporary Mali, there are literally dozens of ethnicities that can claim indigeneity. Furthermore, governance is

[1] Interestingly, there is an inversion of the acceptability of other terms between French and English. While the label peasant is uncomfortable to use in American English, in Francophone West Africa, the label "*paysan*" (peasant) is the normal way of referring to someone who makes their living from the land, be they farmers, herders or fishermen. However, the Fulani herders I knew who spoke French, would only use "*paysans*" as a label for farmers. The Fulani always referred to themselves as herders (*eleveurs*), even if they didn't own many cattle.

ethnically mixed, meaning there is no ethnic ruling class against which any indigenous groups could be contrasted.

I prefer the term “local knowledge” because it is a more generic term that carries fewer overtones than the word “indigenous”. The label “local knowledge” frees me from questions of ethnic authenticity and origins of knowledge that would complicate research while contributing little benefit. As I use it, “local knowledge” simply means knowledge that is held locally, regardless of the constitution of the community or the knowledge. As such, there can be many different sources of local knowledge including, but not limited to, personal observation, informal education, formal education, agricultural extension, information gained while traveling to other parts of the world, and so on. Knowledge likely varies from person to person, even to the point when one may contradict another.

I see local knowledge as being an open system, ready to incorporate new information as it is gained. This is in direct contrast to its portrayal by early proponents of its use in development. In a seminal work on indigenous knowledge in development, Howes and Chambers (Howes and Chambers 1980:330) describe how indigenous technical knowledge (ITK) “as a closed system, is characterized by a lack of awareness that there may be other ways of regarding the world”. I found in Mali, however, that local knowledge was far from a closed system. In a region that has a long tradition of ethnic, religious and linguistic pluralism, as well as a tradition for young people to travel long distances to seek work in their youth, it would be impossible for local knowledge to be as insular as Howes and Chambers describe. It is equally unlikely that people are unaware that there are other ways of looking at the world. Howes and Chambers have defined any open or partially-open informational system as being outside the category of indigenous knowledge, reintroducing

the problem of authenticity. Does outside information so taint indigenous knowledge systems that we can no longer consider them legitimate indigenous knowledge systems? If so, what does it make them?

Some might say that introduced information, such as that from agricultural extension, should not count as local knowledge because it originates in institutional science. Some might even propose that introduced knowledge destroys local knowledge systems. However, if we accept that local knowledge systems have always been dynamic, processual phenomena that incorporate and discard information depending on its utility and effectiveness, I would propose that the origin of information in a body of local knowledge is not of great importance. Even without the interventions of the state and its scientific institutions, in the dynamic, multi-ethnic landscape of central Mali, there has undoubtedly been at least some exchange of technical information between ethnic groups. I personally have seen this illustrated by the presence of Fulani vocabulary used in Bambara and Bambara vocabulary used in Fulani. While my research did not explicitly address the question of their openness, I find the proposal that local knowledge systems are closed and that adherents "lack an awareness that there may be other ways of regarding the world" as entirely untenable in my fieldwork setting.

Local knowledge does not necessarily have to be "traditional" or even of local origin. The important part of local knowledge is not where it comes from, but simply that it is held, and to some degree shared, by people in a locale. Inasmuch as this is true, it will affect their understanding of ecological and social phenomenon and will guide their behavior within their social and ecological environment, wherever that may be.

Another reason why I prefer the term "local knowledge" is its inclusiveness. Much research, particularly research done in relation to development efforts, has focused on technical aspects of knowledge systems (see Warren 1995; or Brokensha 1980 for numerous examples). Warren (Warren 1998a) points out that the term "indigenous knowledge" was first used in 1979 in a context explicitly devoted to development. The term "indigenous *technical* knowledge" was used to tease apart practical knowledge, knowledge that development professionals and hard scientists can relate to, from some of the abstract, qualitative or cosmological beliefs that fit less comfortably into the scientized and professionalized world of academic research and international development. This illustrates that in an effort to bring indigenous knowledge closer to the center of a new, ground-up development, the Western construction of "indigenous knowledge" as technical initially wrote out broad cosmological aspects of those knowledge systems.

My research starts with technical knowledge, but I will also be examining non-technical components of local knowledge, such as peoples' senses of ethnic identity (as well as their characterizations of other ethnicities) and knowledge of local history. Both of these affect NRM decision-making, land tenure claims and adaptive strategies of the local people. As such, I propose that they are important aspects of local knowledge and need to be incorporated with "technical" knowledge for a broadly-based and effective applied anthropology.

Finally, the inclusiveness of the phrase "local knowledge" also has advantage in that it can be applied anywhere. Anthropology is the study of humanity in its entirety, not just the part that finds itself in the "underdeveloped" part of the world. As such, the concepts constructed within the discipline should ideally be applicable across humanity. Local

knowledge, as I conceptualize it, can be found among to suburban American home gardeners just as easily as it can be found among Amazonian hunter-gatherers. However, I suspect most people in the anthropological research community would not be comfortable discussing the "indigenous knowledge of suburban American home gardeners". While I recognize that some anthropologists might oppose this characterization, saying that American home-gardeners knowledge might be too informed by scientific research to be accurately called local, I again reiterate that provenance of information is less important than the fact that it is held. Furthermore, I would call into question the total dichotomization of local knowledge and scientific knowledge.

Local knowledge and scientific knowledge

Having established my preference for the term "local knowledge", I will reexamine what the term has meant in the broader picture of research and rural development. I will occasionally employ the label indigenous, because it is found throughout the literature, making it somewhat difficult to avoid. Making generalizations about local knowledge systems is always difficult due to a broad range of topics that fall within that and the unclear boundaries of what constitutes local knowledge. This is particularly true when discussing he relationship between local knowledge and scientific knowledge.

Using systematic measures and hypothesis testing, European research communities have sought to produce universalistic knowledge since the time of Isaac Newton, if not Francis Bacon. It is not difficult to see how universalistic knowledge and scientific knowledge have come to be considered synonymous, particularly when they have been deployed by colonial regimes in order to increase and to justify their exertions of power. The

very labels “local” and “indigenous” set up a dichotomy that suggests local knowledge is not scientific because it is not universalistic.

The distinction between scientific and local knowledge has been central to research addressing how the two forms of knowledge articulate. Since the beginning of ethnoecology, anthropological research has often validated local biological knowledge by showing that it is consistent with, and sometimes even more elaborate than, universalistic knowledge systems (Berlin 1992; Berlin, et al. 1973; Boster 1996; Conklin 1954). This validation has been positive in many ways, legitimizing rural lifeways that had previously been dismissed by Western scientists and the urban ruling-classes. Unfortunately, the linguistic twist that made universalistic knowledge and scientific knowledge one in the same, has inappropriately transformed into a sharp distinction between local knowledge and scientific knowledge, one that automatically implies that local knowledge is not scientific.

Local knowledge systems are based on systematic observation of empirical phenomena. Observation in local knowledge systems is often done informally and in conjunction with actual production. In addition to general observation, there is some degree of experimentation in local knowledge systems. Some researchers have documented systematic experimentation by rural people as a source of technical innovation (de Boef, et al. 1993; DeWalt 1994; Rhoades and Bebbington 1995; Rhoades and Booth 1982; Richards 1985; Richards 1986; Warren, et al. 1995). Folk experimentation is often not strictly quantitative and controls are vague, if existent at all but it is a form of systematic testing of new ideas nonetheless.

Research on local knowledge has frequently focused explicitly on technical knowledge, ignoring the non-technical, ideological aspects of local knowledge. Development

professionals are more likely to be interested in a particularly adaptive agricultural behavior more than they might be interested in the ideology, the appeasement of natural or ancestral spirits for example. Although local knowledge contains many empirical observations, the non-empirical elements, what Rappaport might have called “cosmological axioms” or “cultural values”, should not be written out of local knowledge systems, as they are part of higher order cognized models that encompass ethnobiological classifications and management strategies (see Chapter 1 for discussion of Rappaport’s notion of cognized models).

Like local knowledge systems, institutional scientific knowledge relies on systematic observation of empirical phenomena. Contemporary Western science typically relies heavily on experimentation, which is simply a more intensive and controlled systematicity. Detailed quantification and an emphasis on controls are the norm. Although scientific philosophy may not validate non-empirical propositions, it is not mutually exclusive with “cosmological axioms” that supercede it. There are many scientists who hold supernatural beliefs that are not scientifically measurable or verifiable, and which can influence their behavior as scientists. While science as a method is empirical, the beliefs of those who adhere to science as a knowledge system need not be limited to scientifically verifiable truths. If cosmological axioms and cultural values are to be included as local knowledge, cosmological axioms and cultural values should not be compartmentalized away from scientific knowledge either.

Scientific method aims to create detailed results that not only describe phenomena, but indicate the mechanisms through which phenomena unfold. The focus on mechanisms, the natural principles or laws according to which nature is ordered, is what makes for the universalistic aspect of science. Traditionally, one of the fundamental goals of the overall

scientific project is to develop a universal system of description of natural laws that apply equally well everywhere, what Latour (Latour 1986) called “immutable mobiles”. DeWalt described Latour’s concept of immutable mobiles as

> information that can be transferred without transformation to any spatial or social location. That is, science searches for knowledge that does not change depending on the context i.e., is immutable), thus it should be possible to easily relocate knowledge from the specific circumstances in which it is created to other contexts (i.e., make it mobile) (DeWalt).

Local knowledge systems do not explicitly seek out immutable mobiles because they are typically not as focused on mobility as Western science. This is largely because the holders of local knowledge do not presume nor expect to master as many “spatial or social locations”, which is to say that local knowledge tends to be particularistic in its focus, what many anthropologists have called “place-based”. This is, however, circular logic. If it weren’t particularistic in its focus, it would not be considered a local knowledge system. The particularistic nature of local knowledge is a function of its social context, which is not imbued with nor connected to enough power that there would be reason for an universalistic outlook. Local knowledge is particularistic because it exists and is reproduced in a social context where its primary measure of worth is the successful subsistence of the holder of the knowledge rather than the universal applicability of that knowledge.

While social context could be seen as a difference between scientific and local knowledge, it could also be seen as a similarity. Scientific epistemology is equally a product of its social context. Rather than being grounded in local production, the social context of science is closely linked to structures of global power. The social context of universalistic science has nearly always been tied to hierarchical systems of knowledge production and diffusion. These hierarchical systems have largely been funded by state institutions with political governance interests that are furthered by scientific advancements. It is not

coincidental that universalistic science saw its fluorescence in Europe at the same time as the global expansion of European power, nor is it coincidental that contemporary local knowledge studies are typically done among relatively disempowered groups. It is the very condition of relative disempowerment that makes their knowledge “local”.

Another difference in social context is that scientific knowledge is produced by specialists who generally need degrees or some sort of state certification for credibility. This makes scientists accountable to degree granting institutions and senior researchers, who are subsequently beholden to state (and increasingly corporate) structures that fund, manage and accredit them. Alongside this, researchers’ careers and egos are often closely associated with the advancement of particular ideas, adding another political element to the production of scientific knowledge. Transmission of knowledge under this system is typically conducted through formal channels of information flow, such as publications, classes, and outreach programs, that are controlled by state and corporate interests. These factors lead to a hierarchical chain of accountability up through the system of scientific knowledge production. Peer review and social acceptance of ideas are important aspects of institutional science, but these still take place within hierarchical institutional settings. In local knowledge systems, on the other hand, information is usually informally produced and diffused and personal advancement is unlikely to be tied to particular ideas or techniques, largely because hierarchies as less a part of the structure of knowledge production and diffusion. For farmers, success is not a limited good, whereas in scientific institutions, there are only a limited number of positions and a limited amount of research funding.

Much like scientific knowledge, local knowledge is a cognitive construction of the environment based on systematic observations of empirical phenomena. While local

knowledge may not generally be as systematic as controlled experimentation, it is systematic enough in that it is produced and reproduced in the context of regular and important subsistence behaviors. The applicability of local knowledge as a guide to behavior is to some degree limited to the environment in which it was generated or at least the environment in which it is held and employed. Someone may travel and acquire new information elsewhere, or new information might be introduced to them, but the degree to which knowledge is maintained and used is what determines its status as "local knowledge". Conversely, if someone travels and settles in a new region, they will either have to alter or augment their knowledge to suit the new environment, or they may hold fast to knowledge acquired elsewhere, which can prove to be maladaptive in the long run.

Figure 2.1 summarizes my comparison of scientific and local knowledge systems. Methodological and epistemological comparisons, which encompass the first three items, show only minor differences between the two. While local knowledge and scientific knowledge are both based on observation of empirical phenomena, scientific knowledge generally has a more hierarchical and upward-looking accountability, while local knowledge has socially-diffuse accountability. Their methodological approaches, however, are not fundamentally different. The major contrast between local knowledge and scientific knowledge is that their social institutional contexts are so different.

Scientific Knowledge	**Local Knowledge**
Empirical, plus	Empirical, plus
Systematic, formal	Systematic, informal
Experimental/observational	Observational/experimental
Universalistic	Particularistic
Specialist producers	Non-specialist producers
Institutionally centralized	Institutionally diffused
Formal transmission	Informal transmission
Hierarchical accountability	Egalitarian accountability

Figure 2.1. Scientific and local knowledge systems compared

Local knowledge, at least non-specialist knowledge, is accountable only to the people who hold it, who use it as a reference point for their own behavior. If it successfully guides behavior, it works and will be retained. There are no centralized institutions for verifying its quality or accuracy, no one to critique the methodological rigor of its production, no funders to satisfy, no professional aspirations to fulfill. Scientific knowledge, on the other hand, is aimed at developing universal systems of analysis, description and understanding. Because the institutional structures in which it has developed have been aimed at a global-scale governance, Western science has a more hierarchical structure of accountability. Scientific research has its roots in a sort of community, albeit an highly educated and geographically dispersed community, but it also has disciplinary and subdisciplinary organizations that have a strong normative aspect to them. Also, Western science arose largely as a branch of the modern nation-state and has historically functioned in service and accountability to it. Nation-states (and more recently corporate entities) fund scientific research that serve their needs and interests, often burying findings that contradict their interests. In this context, the acceptance of the findings by the state and scientific community is as likely to affect the success of the researcher as utility of research for rural producers.

Local knowledge systems and scientific knowledge systems are not fundamentally incompatible or epistemologically different. They simply come from different places and are produced, managed, accessed, and redeployed by people who hold different positions in relation to geopolitical structures. This finding is very relevant in the examination of how scientific and local knowledge systems articulate in the context of agricultural development.

Local knowledge in development

Anthropologists, along with many geographers, have advocated increasing the inclusion of local knowledge into agricultural development. Agricultural Development, with a capital A and D, represents the meeting of nation-state or global level institutions and rural producers. Both come to the meeting with knowledge, interests and goals, but not with equal power. Agricultural anthropologists are uniquely situated, both practically and theoretically, to explore the ways that local knowledge (and practice) articulates with scientific knowledge (and practice), as represented in national and global institutions of development (Rhoades 2005). Practically speaking, anthropologists are often "cultural brokers" between rural folk and research scientists in interdisciplinary development contexts. Anthropologists are often responsible for understanding local knowledge and practice, then conveying it to team-members (agronomists, economists, ecologists, etc.) so that their technical and organizational interventions will have a better chance of successfully addressing local needs and goals in a culturally appropriate way.

Theoretically speaking, anthropologists have several tools that make us well-situated to be cultural brokers in development. In addition to our specializations in the study of local knowledge and practice, we are equipped with concepts that allow us to look at different ways of knowing through the lens of relativism, including the very institutions in which we ourselves are based. We are also equipped with theoretical approaches that permit us to analyze the dynamics of power relations that are inherent in the meeting of global research and development institutions with rural agricultural producers (Escobar 1999; Fairhead 1993; Fairhead and Leach 1996; Greenberg and Park 1994; Gupta 1989; Nader 1996; Purcell 1998; Stonich 1996). One of the primary differences between scientific and local knowledge

systems is their institutional affiliations, which is to say their relationships with power. The meaning of the current discourse on local knowledge and participatory development has been interpreted in a number of ways, ways that sometimes contradict each other.

Purcell (Purcell), tracking the rise of modernism and applied anthropology, delineates the ways that anthropologists have been culture brokers, particularly between colonial regimes and the subjects they governed. He characterizes much of the work of early anthropologists and ethnologists such as Cushing, Firth and Malinowski as seeking "to accomplish the paradoxical task of humanizing colonialism" (Purcell 1998:261). On one hand, many anthropologists served the deplorable colonial project, whether explicitly or implicitly. On the other hand, many were guided by humanistic desires to soften the blow of colonialism and modernism, which they saw as unavoidable, by making administrators more sensitive to the needs and values of the folk, and by guiding the folk though the growing pains of entering life under modernist regimes of power.

Purcell (1998) observes that the rise of development anthropology occurred in the 70's and 80's, the same era as the broad recognition of the failure of top-down, capital-intensive, technology transfer models of development at the global level. Reactions against Western-centric models of development caused many anthropologists to look more closely at development goals and approaches of people in their research locales. Purcell suggests that the entire local knowledge trend in anthropology constitutes an implicit and sometimes explicit, critique of Western scientific epistemology, relying on the dichotomization of local and scientific knowledge systems.

> Placing indigenous knowledge and Western (scientific) knowledge on a comparative analytic plane has a number of important implications for this [anthropological] brokering process. First it locates the historical struggle between the cultural rights of indigenous peoples and the dictates of positivist-inclined science within academic discourse as a political and ethnical issue. The schism between indigenous knowledge and "Western" knowledge . . . is

> ideological, it is ethical, and it is epistemological. Once these dimensions are made explicit, we can begin to bridge the gap between methodology and ideology by showing the hidden interdependence that has existed all along. The second implication is that the epistemological parity of both knowledge systems underscores the recognition . . . that anthropology is not simply cultural study but also, and equally important, cultural critique and transformation (Purcell 1998:68).

One of the premises upon which Purcell builds his argument is that scientific knowledge and indigenous knowledge are fundamentally different; ideologically, ethically and epistemologically. In the last few decades, anthropologists, along with indigenous peoples themselves, have promoted the placement of indigenous and scientific knowledge in positions of "epistemological parity" in world of international development and geopolitics. Examining the historical development of this process, Purcell portrays it as a emergent form of cultural critique, resistance and transformation of Western, science-dominated culture. For Purcell, this cultural critique exhibits a component of moral choice for applied anthropologists, wherein we must either become "facilitators of local autonomy" or "agents of hegemonic 'progress'" (Purcell 1998:267). He recognizes, as others have (Sillitoe 1998), that this moral choice and its consequences are fraught with difficulties and uncertainties, largely due to anthropologists' ambiguous position in global knowledge/power systems. However, the humanist applied anthropology he endorses requires that indigenous knowledge and indigenous perspectives are promoted as a means of resistance against hegemonic forces of scientific knowledge and global governance.

Not all researchers agree with belief that local and scientific knowledge are fundamentally different, nor do they believe that the way local knowledge is often promoted is necessarily emancipatory. Where Purcell sees setting up indigenous knowledge against scientific hegemony as cultural critique, Agrawal critiques the foundations of the dichotomization, questioning the "validity, even the possibility, of separating traditional or indigenous knowledge from western or rational/scientific knowledge" (Agrawal 1995:414).

Not only does he challenge the distinctions between local knowledge and scientific knowledge, he scrutinizes the notion that promoting local knowledge is an effective act of resistance to scientific hegemony. Based on a review of the literature on local knowledge in development, Agrawal finds three major themes used to differentiate local knowledge from scientific knowledge.

> We must consider three chief dimensions: 1) substantive – there are differences in the subject matter and characteristics of indigenous vs. western knowledge; 2) methodological and epistemological – the two forms of knowledge employ different methods to investigate reality, and possess different world-views; and 3) contextual – traditional and western knowledge differ because traditional knowledge is more deeply rooted in its context (Agrawal 1995:418).

Agrawal then goes on to dispute all three of these assertions of difference. Proponents of the claim of substantive difference base their argument on the notion that local knowledge systems are technical and oriented toward fulfilling immediate needs while scientific knowledge systems are abstract and theoretical. Agrawal counters that there are numerous indigenous knowledge advocates who themselves have found knowledge that is largely theoretical rather than technical, citing Norgaard (Norgaard) and Richards (Richards) among others. The tendency for advocates to characterize local knowledge as being largely technical and concerned with immediate needs, seems likely to have been influenced by the origin of the research trend, which explicitly focused on "indigenous technical knowledge" because of its utility in development (Warren 1998a). Agrawal points out that the characterization of science as purely theoretical and abstract glosses over the degree to which scientific research and innovation is driven by utilitarian purposes.

Agrawal also challenges the notion that the methodologies and epistemologies of local and scientific knowledge systems are fundamentally different. In Western conventional wisdom, he says that science is typically characterized as

> open, systematic, objective and analytical, and advances by building rigorously on previous achievements. . . . Indigenous knowledge, in contrast, is no more than common sense; it is closed, non-systematic, without concepts that would conform to ideas of objectivity or rigorous analysis, and advances, if at all, in fits and starts (Agrawal 1995:424).

Drawing on contemporary philosophers of science, Agrawal finds that Western attempts to clearly delimit the methodologies that do and do not constitute Science have met with failure, meaning that the line between scientific and non-scientific epistemologies remains blurry, if it remains at all. Furthermore, philosophers of science such as Feyerabend (1975) have found that there is, in fact, a great deal of close-mindedness and dogmatism among scientists for ideas not developed from within the institutional setting of science, seriously undermining science's claim as an open epistemology.

The proposition that local knowledge systems are intellectually closed is even less tenable. As Agrawal points out, research shows a wide variety of responses to new information or techniques introduced into local knowledge systems. These reactions range from full rejection to full embrace, illustrating that there is openness in folk culture, even if it is not uniform. The notion that local knowledge systems are closed also seems to myopically assume that they there is no inter-cultural information flow other than from Western institutional sources to local folk. In my own field site, I have seen evidence of inter-cultural exchange of information in the fact that the Marka farmers have, within the last two generations, begun to keep sheep and goats. While some contract herding out to Fulani, others choose to keep that labor in the household, necessitating the acquisition of necessary knowledge and techniques from the Fulani who had previously been the only herders in the area, illustratinges the openness of local knowledge systems.

Finally, Agrawal addresses the premise that local knowledge is embedded in its cultural and ecological contexts, whereas science draws its strength from its objective nature

and its ability to make generalizations. Science, we are led to believe, is acultural and acontextual. Agrawal first attacks this idea by claiming that technocentric, top-down development has historically failed exactly because it did not adequately consider social, political and cultural contexts that it was attempting to improve. This failure calls into question the strength of western scientific knowledge in applied contexts. He then draws on the sociology of scientific knowledge (SSK) literature, to examine science as practice, as a set of behaviors that occur within a cultural context and are heavily shaped by cultural discourses.

After debunking the notion that scientific knowledge is acontextual, Agrawal criticizes attempts to preserve knowledge systems in databases maintained by global institutions. According to Agrawal, many advocates argue that the strength of indigenous knowledge is in its cultural embeddedness, but then attempt to disembed atomized fragments to put into national and global databases of indigenous knowledge. These databases can accessed and the information therein can be later be redeployed in new contexts by INGO's or even by other indigenous people. The inconsistencies inherent in this practice, Agrawal contends, defeat the bottom-up development perspective that many advocates of indigenous knowledge espouse. On one hand, indigenous knowledge and indigenous people are valorized, finally gaining recognition as important, insightful and constructive. On the hand, this form of valorization pulls indigenous knowledge into the sphere of Western knowledge/power systems, and not on its own terms.

> How knowledge is generated, organized, stored, and disseminated presupposes certain relationships of power and control. Ignoring these relationships will disadvantage those who do not have access to international travel, western languages, or technical expertise in computer based information storage – in short, indigenous peoples . . . . If indigenous knowledge are disappearing, it is primarily because pressures of modernization and cultural homogenization, under the auspices of the modern nation-state and the international trade system, threaten the lifestyles, practices and cultures of nomadic populations, small agricultural producers and indigenous peoples. Perhaps these groups are fated to disappear.

> But their knowledge certainly cannot be saved in an archive if they themselves disappear (Agrawal 1995:431).

Agrawal's believes that academic documentation of local knowledge does not necessarily contribute to the well being of the rural people. Instead, the decontextualization of local knowledge by institutional science, as represented by anthropologists, makes it another tool for the Western knowledge/power complex. Even the apparent elevation and valorization of indigenous knowledge can be a contributing force to its destruction. Agrawal fails to acknowledge, however, that many indigenous groups have sought out anthropologists to document their traditional knowledge systems, which are perceived as eroding due to increased influence of global cultural forces. Furthermore, many anthropologists have been instrumental in supporting indigenous struggles against state and corporate interests, especially for land rights and intellectual property rights, and the documentation of indigenous knowledge systems has been instrumental in many of these struggles. Although Agrawal neglected important aspects of the relationship between indigenous knowledge and anthropological research, his critiques merit serious consideration. Regardless of whether one prefers to defend or critique institutional structures of local knowledge research, Agrawal's argument highlights that differences between local and scientific knowledge systems lie more in their relationships with power than their epistemologies.

Ethnopedology

Research on local knowledge of soils comes from a variety of research traditions, such as geography, anthropology, agronomy and soil science. Some have focused on knowledge systems, while others have focused on management practices and techniques. The most predominant approach among them has come from the ethnoecological tradition. The subdiscipline of ethnoecology began in the late 1950's and 1960's, when scholars such as

Conklin (Conklin 1954; Conklin 1957; Conklin 1967); Goodenough (Goodenough 1957), Frake (Frake 1962), and began publishing on the importance of linguistic classificatory systems as cultural devices that bring cognitive order to a complex world. Research began to reveal the existence of intricate and detailed folk knowledge of the environment. Today this seems nearly self-evident, even in popular culture, but at the time it was a revolutionary idea for the Western research, development and governance agencies who had been operating on the model that uneducated rural folk engaged in irrational productive behavior because of their lack of (scientific) knowledge of biology.

The early works in ethnoecology focused on botanical nomenclatural systems, most likely due to the rich biological diversity and cultural salience of plants throughout the world. This has continued to be true of the later generations of ethnoecology in the 1970's and 80's (Berlin, et al. 1973; Boster 1984; Brown 1976; Brown 1985; Hunn 1982). A central theoretical component of ethnobiological studies has been the identification of taxonomic systems representing the cognitive structure of folk knowledge of the environment. Cross-cultural comparison of these taxonomic structures has been used to illustrate some universal principles of the structure of the human mind, proving that the unity of the human species through our shared cognitive patterns (Berlin 1992). This seems self-evident today, but at the time it was a powerful statement against the quasi-biological reification of culturally constructed racial categories.

Ethnopedology is among the lesser developed branches of ethnobiology, though recent publications show that that is quickly changing. The word "ethnopedology" itself was not coined until the early 1980's, a time when other ethnosciences were already highly developed and refined. But from the beginning, Williams and Ortiz-Solario sought to

distinguish ethnopedology from other ethnosciences by having explicitly applied goals, by being highly multidisciplinary, and by including a broad range of kinds of data within the fold ethnopedology.

> Folk perception of soil properties and processes, folk soil classification and taxonomy, folk theories and explanations of soil properties and dynamics, folk soil management, folk perceptions of the relationships between soils and plant domains, comparison between folk and technical soil science, assessment of the role of folk soil perception in agricultural practices and other behavioral realms all may be encompasses under the term "ethnopedology". . . . Since the relevance of the subject transcends concern for cognitive orientation, and since in its applied aspects the focus remains folk, the multiple connotations are useful in order to maintain a desired interdisciplinary perspective (Williams and Ortiz-Solario 1981:335-336).

In this seminal paper, Williams and Ortiz-Solario describe the folk soil classification system among the Tepetlaoztoc people in central Mexico, using the standard taxonomic methods used in other branches of ethnobiology. The Tepetlaoztoc divide their soils into three lexical levels based on color, texture, water retention, consistency, and workability. Scientific classification of the same soils used all of these qualities except the last, and parsed the soils out into six levels.

Following 1981, ethnopedology has gradually gained momentum as a research subject among a wide variety of researchers in anthropology, geography and agronomy and soil science. Seventeen years later, Talawar and Rhoades (1998) reviewed the development of the field of ethnopedology, finding that most research had fallen into four broad categories: descriptive classificatory studies, comparison of local and scientific categorization criteria, scientifically measuring for physical and chemical traits of local soil categories, and land management strategies.

Commenting on descriptive classification studies, Talawar and Rhoades (Talawar and Rhoades 1998:5) note that "a system of clearly categorized soil classification does not always exist", cautioning ethnopedological researchers that what they are looking for may not

actually exist. Research comparing farmers' criteria for soil evaluation with scientific criteria for soil evaluations, revealed that color, water permeability, water retention and texture were common criteria in folk classificatory systems and that these criteria are subsequently important in land management decisions. The third category of research takes this comparison a step further, by measuring the physical and chemical properties of locally-classified soils. Some such studies have verified that local classificatory schemes correlate with measurable and significant differences in soil conditions. Finally, there is research that addresses soil typology as a factor in agricultural management and decision-making. This commonly means exploring the suitability of particular crops to particular types of soils.

Ethnopedological classification systems have proven far less uniform than those found in ethnobotany. For example, botanical classifications – including both folk systems and the Linnaean system – consistently adhere to highly consistent taxonomic structures. This is said to be caused by universal patterns of perception, revealing the cognitive unity that encompasses all of humanity (Berlin 1992; Berlin, et al. 1973; Boster 1996). Ethnopedological systems are distinct from others in ethnoecology in that they have not consistently exhibited a universal taxonomic structure. A cross-cultural survey of ethnopedological systems reveals high variability in degrees of differentiation. They also exhibit high variability in the degree to which folk taxonomies and scientific taxonomies reveal universal cognitive structures (Kerven, et al. 1995; Sillitoe 1996; Talawar and Rhoades 1998; Williams and Ortiz-Solario 1981; Zimmerer 1994).

The variability exhibited in ethnopedological taxonomies is a function of several factors: the non-discrete nature of soil in general, the inherent blurriness of boundaries

between soil types and the close association of soil categories with specific behavioral management prescriptions.

> Soil has no sharp boundaries to begin with, no discrete readily isolated units (like individual plant or animal organisms) on which to base species classes. It comprises a continuous mantle across the Earth, featuring no natural sharply defined discontinuities. Soils grade imperceptibly on into another, comprising a continuum both laterally and vertically in space, whereas classifications demands breaks of divisions, boundaries on soils, lacking natural discontinuities for the purpose. . . . Furthermore, soil not only varies continuously over space but it also varies over time. It is a dynamic not a static medium and we need a flexible ordering scheme that can keep up as time passes by, can accommodate temporal variations (Sillitoe 1996):267).

The inconsistency between folk and scientific categorization is largely explained by the fact that folk taxonomies of soils are more closely associated with use value, whereas scientific taxonomies are based on chemical and geophysical properties.

Nevertheless, the typological approach has dominated ethnopedological research within both anthropology and geography. A large part of ethnopedological research has been done on the comparison of folk criteria with scientific criteria and scientific evaluation of folk classifications. The examination of classificatory criteria begins to get past the simple identification of local soil typologies and gets into the perceptual cues that people use to construct these categories. While color and texture are nearly universal criteria, others include water retention, crop suitability, and position in landscape (Conklin 1957; Dialla 1993; Kerven, et al. 1995; Zimmerer 1994).

Taking this a step further, after identifying folk classifications, some researchers have taken soil samples for the purposes of scientifically evaluating local soil categorizations (Behrens 1989; Conklin 1957; Williams and Ortiz-Solario 1981). They typically found that local soil categorizations correlate with significant chemical differences in the soils.

Studies that examine the relationship between soil categorization and management behavior have typically taken looked at correlations between identification of soil types and

crop selection, most of these finding the crop choice made at the species level (Behrens 1989; Netting 1968; Osunade 1988; Osunade 1992). In a particularly interesting elaboration on this theme, Bellon and Taylor (Bellon and Taylor 1993) found that in southern Mexico, farmers' access to different soil types had a direct affect upon their use of maize varieties, adopting improved varieties for use in particularly rich types of soil and employing landrace varieties in less fertile soils. Others have used local soil typologies within the context of decision modeling systems in an attempt to predict management regimes under conditions of environmental change (Furbee 1989; Guillet 1989).

In *A Place Against Time,* Paul Sillitoe (Sillitoe 1996) raised the bar for research on local knowledge of soils. He devotes a good deal of space to local classifications and the soil chemistry associated with them, deftly interweaving quantitative and technical soil science with anthropological insights. Within anthropology, he pushes the boundaries of ethnopedology by including a wide variety of cultural information as aspects of local knowledge of soils. He does this because he is critical of

> the emphasis that anthropological ethnoscience places on the classification of phenomena at the expense of exploring the understanding that people achieve of their natural world, in part using their taxonomic schemes, of their place in it and ability to manipulate it (Sillitoe 1996:8)

For example, Sillitoe goes beyond typology to examine the local knowledge of the relationship between soil and weather patterns, geology, botanical communities, erosion, human agency (usually in the form of swidden agriculture). Moreover, he includes aspects of Wola cosmology and associated ritual practices that link the spiritual world with ecological processes. Within the Wola world, he contends, these are all aspects of soil knowledge that should be considered by good ethnopedological research. Rather than compartmentalizing technical knowledge, as much previous research had done, Sillitoe provides a rich and

holistic ethnography of one ethnic group's relationship with the land. What is powerful about *A Place Against Time* is that there is such emphasis on knowledge (and practice) that is processual, rather than classificatory, in orientation. Sillitoe's multifaceted portrayal of ethnopedology incorporates cultural constructs of interrelated phenomena that span across ecological, behavioral and ideological spheres. This achievement is capped by the fact that he is simultaneously able to incorporate detailed quantitative information of soil ecology (Sillitoe 1996).

To provide further evidence of the growth of ethnopedology as a subdiscipline, in 2003 *Geoderma* published an entire issue dedicated to ethnopedology, and this in a soil science journal that does not usually include a lot of social science. It is telling that the volume has a couple of articles that serve as introductions and field statements, calling for the expansion of ethnopedology in several diverse directions, most of which follow Sillitoe's (Sillitoe 1996) lead.

Barrera-Bassols and Zinck (Barrera-Bassols and Zinck 2003) provide a broad overview of ethnopedology, first identifying the conceptual scope, methodological diversity and primary research themes found in the discipline. In so doing, they again classify ethnopedological research into four general categories, effectively the same four used by Talawar and Rhoades (Talawar and Rhoades 1998). Borrowing a conceptual structure of local knowledge from Altieri (Altieri 1993), Barrera-Bassols and Zinck divide ethnopedology into three overarching domains, Kosmos (cosmological beliefs and symbolic constructs), Corpus (cognitive knowledge systems) and Praxis (management practices and behaviors), what they call the "K-C-P complex" (Barrera-Bassols and Zinck 2003:172). Despite identifying these three domains, they point out that the overwhelming majority of

ethnopedological research focuses on Corpus and Praxis. Conversely, the domain that includes cosmological belief systems, symbolic meanings of soils and land features, and land-oriented rituals has largely been neglected. While encouraging more research in all of the domains, Barrera-Bassols and Zinck suggest that more research needs to be done on cosmological aspects of soil knowledge in order to balance ethnopedology as a whole.

Neimeijer and Mazzucato (Niemeijer and Mazzucato) call for ethnopedology to move beyond static taxonomic representations of knowledge and include more exploration of local knowledge of soil ecology and processual elements of agroecology that make up soils management. Soils and soil knowledge, both being dynamic by nature, cannot be adequately represented in a simple and static taxonomic tree. Not only is this over-reliance on taxonomies of limited utility to development and the integration of local and scientific knowledge systems, but it does not capture the complexity of knowledge held by rural producers.

Niemeijer and Mazzucato (2003) suggest that future ethnopedological research should focus more on local theories of soil ecology, with an emphasis on conceptualization of processes and interrelationships. This, they say, will capture the "grammar" of ethnopedological systems, rather than just the "sentences", as represented by taxonomies. Such an approach to ethnopedology will be beneficial because "Understanding the differences and similarities between local theories and Western scientific ones will facilitate communication, because scientists and development workers will be able to better explain the points they want to make with the local population" (Niemeijer and Mazzucato 2003:421). Several variations on this theme can be found in the same issue of *Geoderma* (Barriosa and Trejob 2003; Grossman 2003; Osbahr and Christie 2003; Warren, et al. 2003).

In light of my earlier problematization of the topic, it bears pointing out that the dichotomization of local and scientific knowledge is rarely problematized in this volume. Instead, it is usually taken as given in all of the papers. This is not necessarily meant as a criticism, as lengthy epistemological debates would have been an awkward fit in the issue. Citing Agrawal (Agrawal 1995), Niemeijer and Mazzucato (Niemeijer and Mazzucato 2003:421) passingly acknowledge that "We have seen that local farmers' theories of soil go beyond practical rules of thumb to include complex concepts about soil processes and fertility. There is thus little point in dichotomizing local and scientific knowledge". Oudwater and Martin likewise agree with Agrawal, saying they "prefer to think of multiple domains and types of knowledge" rather than a strict local-scientific divide, but they retain the terms local knowledge and scientific knowledge for ease and clarity of language (Oudwater and Martin 2003:390).

Two articles in this issue of *Geoderma* emphasize the need to integrate local and scientific knowledge systems, in both methodological and conceptual terms. Oudwater and Martin (Oudwater and Martin 2003) examine the pros and cons of various methods for eliciting ethnopedological knowledge, trying out interviews (including free lists, sorting tasks, and questions about soil management practices), participatory mapping exercises, and transect walks. While their discussion of the relative merits and problems of ethnopedological methods is insightful, unfortunately the methods are explored simply as ways of eliciting local knowledge by and for researchers. The discussion is not brought back full circle to examine the *integration* with scientific epistemology nor scientific practice. Similarly, Krasilnikov and Tabor inventory the benefits of local knowledge of soils to scientific soils research, but a critically-informed integration is not fully realized. Instead,

they emphasize how local knowledge can be a tool for the improvement and refinement of scientific knowledge of soils. Examples of case studies that seek to integrate or at least reconcile local and scientific knowledge systems can be found in Erickson and Ardon (Erickson and Ardon 2003), Gray and Morant (Gray and Morant 2003), and elsewhere in Gobin et al (Gobin, et al. 2000).

Other cutting edge issues in ethnopedology can be found elsewhere. In an earlier paper, WinklerPrins (1999), who was guest editor for the 2003 *Geoderma* issue on ethnopedology, emphasized the need for more research focusing on knowledge of ecological soil processes, as well as the integration of local and scientific knowledge systems. In addition to these two themes, which are also found in Geoderma, WinklerPrins calls for ethnopedology to include more aspects of the relevant social contexts in which agricultural production takes place. This includes land-tenure practices and institutions, history of land use, social customs and rituals of land management, differential access to land and management resources. This mirrors general trend in other local knowledge research that stresses the inclusion of such factors as history (Ellis and West 2004), concepts of development (Kassam 2002), production-related folklore and taboos (Fairhead 1993). Nazarea explicitly emphasizes the need for ethnoecology to situate itself, its subject and its findings in broader schemes of articulation to make it more accurate and relevant, saying that

> [E]thnoecology needs to come to terms with the situated nature of knowledge, the constraining as well as liberating effect of this locatedness, and the importance of history, power, and stake in shaping environmental perception, management and negotiation. I believ3e that this potentially where ethnoecology can make the greatest contribution to interdisciplinasry research and even to advocacy in such areas as conservation, sustainability, and equity, because no other approachcan draw on a jeweler's tool kit that is so promising for illuminating nuances and dimensions that more operational, quantitative, and macro approaches tend to neglect or glass over (Nazarea 1999:19).

Situating ethnopedology in its social, historical and political contexts will put more focus on land access and tenure issues, differential access to wealth and power over natural resources,

and changing ecological and policy environments. If ethnopedology is to move in this direction, it will necessarily contact and overlap with recent developments in political ecology, which stresses, among other things, the interrelationship of resource management strategies and access to power (Bryant 1998; Greenberg and Park 1994; Stonich 1993). My research integrates local technical knowledge of soils with broader questions of natural resource management that are linked to history, power, ethnic identity and visions for the future of development. Pushing the boundaries of local knowledge increases the potential to make ethnoecology understandable as more than a cognitive system, but as a result of, and a factor in, historical processes of cultural change.

CHAPTER 3

GEOGRAPHIC AND HISTORICAL INTRODUCTION TO THE RESEARCH SITE

Mali: An overview

Mali is a landlocked West African nation, the northern half of which is in the Sahara desert. Further south, as annual average rainfall increases, the landscape gradates to savannah forest in the Sikasso region. Mali's dominant geographic feature is the Niger River, which arcs across the country, flowing northeast from Bamako to Timbuktu before gradually bending southward again. The headwaters of the Niger River are found in the Manding Mountains of Guinea, approximately 240 km (110 mi.) from the Atlantic coast. Despite this, the Niger rivers winds 4,180 km (2600 miles) before reaching the Atlantic Ocean in Nigeria. Mali is extraordinarily flat and the river has no major drops or falls in Mali. Central Mali is so flat that during the rainy season, the Niger River and its smaller, but still significant tributary, the Bani (literally "the small river" in Bambara), spill out of their main channels and flood approximately 77,700 km^2 (c. 30,000 $mi.^2$), creating a massive delta ecology

Figure 3.1 Map of Mali

in the middle of the river. The flood plains of the Niger River Inland Delta (NRID) stretch from the Jenné area all the way to Timbuktu, where the river comes together in a single channel again.

The Niger River is a vital element to the human economy and ecology in the area. In fact, the two major place names of Mali are good indicators of the importance of the river. Bamako, the capitol, is located on the river and is named for a dominant river species. In Bambara, the dominant language in Mali, "*bamako*" literally means "alligator pond". "*Mali*" is the word for "hippopotamus", the most feared and revered animal in the river, known for upending fishing boats and sometimes even killing its passengers (this is done out of territoriality rather than subsistence: hippos are vegetarian). The Niger River provides abundantly productive fishing grounds, easy long-distance transportation for the better part of the year, and water for rice irrigation and power production. Historically, military control of the Niger River, and the substantial trade that it carried, has been an important aspect of the rise and fall of several empires. The inland delta floodplains have been a key resource for transhumant cattle herders in West Africa for centuries, providing an immense and reliable source of water and fodder during the long regional dry season, from December until July.

Figure 3.2. Close up of the Madiama region.

In human terms, Mali is a diverse country. Mali has upwards of 60 ethnic groups with distinct languages and identities. Most of Mali's languages fall within the Mande family, which is a part of the Nilo-Saharan branch of languages. Fulfulde, the language of the Fulani, is one significant exception to this, though there

is little agreement on Fulfulde's language family. Bambara, the dominant Mande language in the area, is by far the most prevalent language in Mali. It has long been used as a trade language across West Africa, from Senegal Burkina Faso, often being shared by people for whom it is not their first language. For example, in the Madiama weekly market, I've seen several instances of Fulani and Bobo speaking together using Bambara as the common shared language. Other major languages in Mali include Fulani, Songhay, Dogon, Bozo, Senufo, Tuareg, Malinké, Sarakolé and Bobo.

The most important public service announcements on national television, such as those promoting a polio vaccination campaign, AIDS prevention or elections, are aired in at least 8 languages, including most of those listed above. Bambara, however is the *lingua franca* of most of the country and is becoming increasingly dominant in Mali. Bambara literacy campaigns, many funded by USAID among others, have pushed the Bambara language further into the sphere of civil society. Like in many other West African countries, there is a growing movement to conduct more early education in national languages in an effort to increase the overall education rate. There are many reasons that children do not continue in school, but lack of comprehension of the language of education must rank high among them[1]. The increasing dominance of Bambara is likewise evidenced by the fact that Bambara is the only national language that is used in programming and advertising on the one national television channel.

[1] Presently, all education after the first year is done in French, despite the fact that most students have little exposure to French outside of the school setting. Conducting education in national languages is controversial and many of the educated people with whom I discussed the topic are not in favor of it. The main contention is the question of which national languages to use and where. The prevailing idea now is to conduct early education in prevailing language of the region. In the highly mixed and diverse (even for Mali) region of Mopti, this would be difficult because there are so many major languages that are widely spoken widely there: Fulfulde, Bozo, Songhay, Dogon, Bobo, Bambara. For government functionaries, who often work outside of their natal linguistic region, this could mean that their children's' schools would be run in Bambara even if that is not the language used at home. Some propose that national language education would lead to a two-tiered educational system, pointing out that political and economic elites, whose wealth and positions are rooted in Francophony, are not likely to want their children to be educated in anything but French, the language of power. The question of education in national languages is likely to be a heavily debated topic in years to come.

However, most ads and programs – such as the nightly news and the wildly popular Latin American telenovellas – are still in French.

Mali is predominantly Muslim, with Christian and animist minorities. This oversimplifies the religious landscape. Although Islam has had strong footholds among urban ruling and trading classes as early as 800 AD, it was not until the last 200 years or so that mass conversions of the general population occurred, sometimes forced under threat of death. The Islam practiced in Mali retains many elements of traditional religion. As a friend in Bamako explained to me

> Mali is 90% Muslim, 5% Christian, and 75% animist. People will give all the appearances of being good Muslims, but when something serious happens, like when a relative gets very sick, and their prayers to God don't fix it, many will seek out sorcerers and make sacrifices to the old idols to try and deal with the situation.

The Commune of Madiama[2]

The Commune of Madiama is situated between the floodplains of the Bani River and the highway that connects the southern and northern parts of Mali. Located on the southwest corner of the Niger River Inland Delta, just 26 km from the city of Jenné (~14,000 residents), Madiama is located at a unique geographical intersection. The terrain is extremely flat and marked by sandy soils with occasional rock outcroppings on the eastern edge of the commune, where the gravelly Dogon Plateau rises gradually to the east of the southern Inland Delta. In other words, the Commune of Madiama straddles the border of the upland-floodplain divide, giving its residents access to both river floodplain and rain fed agriculture. The commune has 12[3] villages with approximately 10,000 – 13,000 total inhabitants. The largest village and capitol of the commune is also called Madiama, which is home to approximately 2200 people.

[2] In order to avoid confusion, I will use "the Commune of Madiama" to refer to the commune in general and simply "Madiama" to refer to the village itself.

[3] Officially, there are only 10 villages. Because a village has been defined as having at least 100 taxable members, any smaller settlements have been combined with another for governmental purposes. There are two instances of this in the Commune of Madiama. The villages of Tatia and Nouna are officially one village. Likewise the villages of Tiyɛn and Doucarani are officially one. This is an administrative fiction and does not reflect anything about the social realities of life in the villages. Each village maintains its village chief and traditional lands.

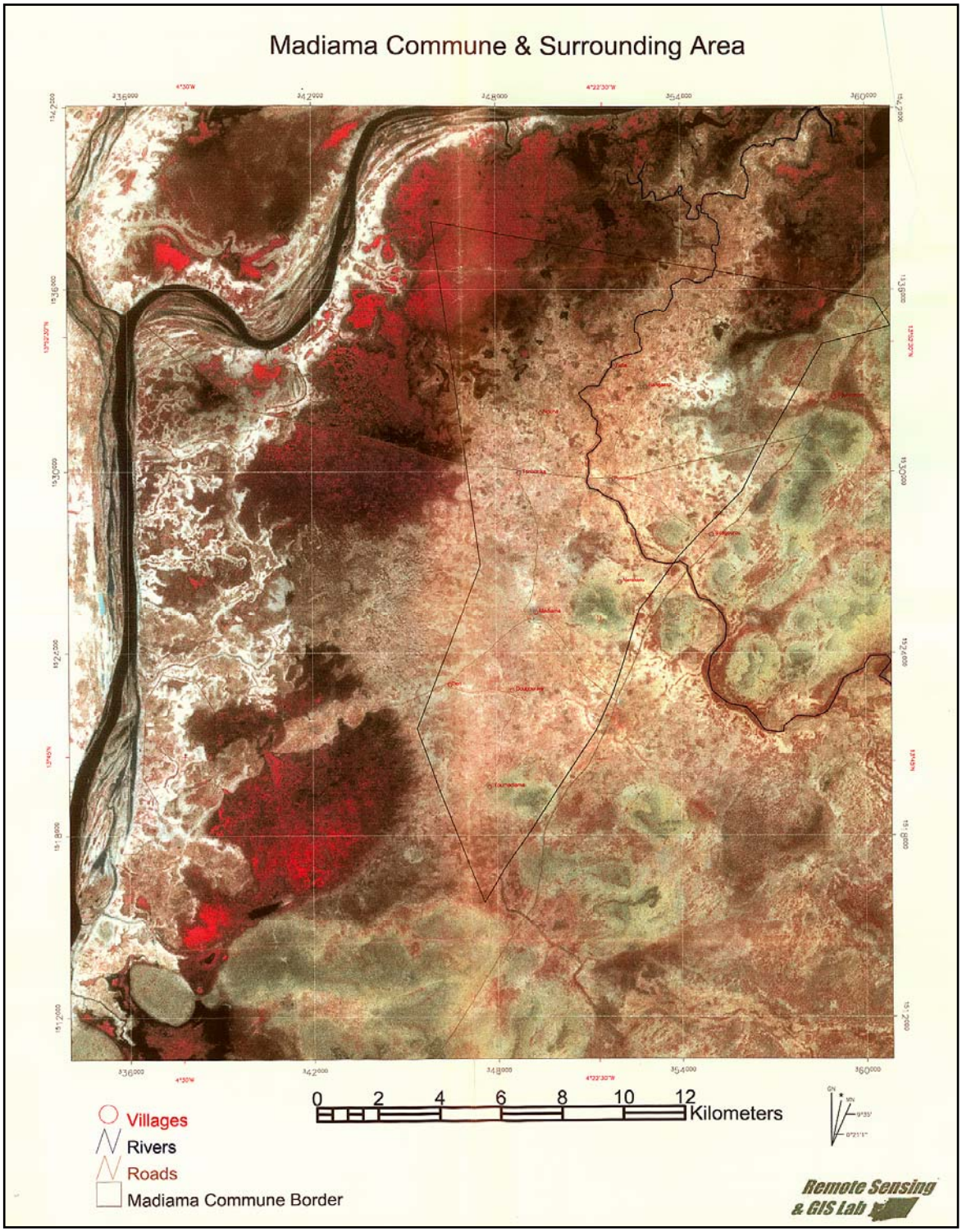


Figure 3.3 The Commune of Madiama in a colored satellite photo. The outline marks the commune's borders. The dark line on the left is the Bani river, the deep red areas are floodzones, the pink is non-flooded zones and the bluish areas are bare soil or rock.

The Commune of Madiama exemplifies an ethnic cross-section of central Mali. Villages are mostly ethnically homogenous because of historical settlement patterns, though there are a couple of exceptions which will be discussed later. The Marka ethnicity, often known as Sarakolé elsewhere, dominates the commune, with ethnic Bambara and Fulani minorities. Historically, there had been a sharp division in the human ecology of this area. The Marka and Bambara were sedentary farmers and the Fulani were nomadic pastoralists. Fulani in this area have traded with other ethnic groups, usually trading milk for grain and other foods. Contemporarily, Marka and Bambara keep some cattle and Fulani engage in agriculture. Although Fulani are customarily nomadic, there are Fulani villages who grow the same range of upland staple crops as farmers of this region. The largest Fulani village in the commune, Nerekoro, is only 3 km from the village of Madiama, and was described by one resident as a "suburb of Madiama", due to high economic reliance on Madiama.

Within a 20 mile radius of the Commune of Madiama, at least 10 languages are spoken as first languages in entire villages: Bambara, Fulani, Bobo, Bozo, Songhay, Dafin, Dogon, Tuareg, Mossi and Sarakolé. Multilingualism is not uncommon and as in other parts of the country, Bambara is the most common shared language, though skill levels vary and there are some who do not speak Bambara. Every village in the Commune of Madiama has a mosque and is officially Muslim. There are both Christian and animist villages to the east and south of Madiama. If you are traveling to Madiama by bus, you get off at a Bobo village just 3 kilometers from Madiama. The village of Kessedougou has neither mosque nor church, as it is neither Muslim nor Christian. Kessedougou is a Bobo village and its residents practice traditional Bobo religion. Despite being in a different commune, and an entirely different region, Kessedougou is closely linked to the Commune of Madiama. Because of Kessedougou's proximity to Madiama, the people of

Kessedougou share the school, the health center and the market in Madiama. As will be discussed in Chapter 4, the villages of Kessedougou and Madiama are also linked, if tenuously, through land-use arrangements.

The staple crops of the region are millet, sorghum, rice, groundnuts[4] and cowpeas. I call these staple crops because they are all grown for storage in family granaries, but they are all also sold as cash crops, especially peanuts and rice. Watermelons and calabashes are grown explicitly as cash crops by men, while women grow okra as both a staple for sauces and as a cash crop. Very recently, lettuce, onions and tomatoes have begun to be cultivated in women's gardens' in the dry and cool season, but this can only be done in the presence of good wells. There are only two such gardens in the Commune of Madiama, one in Torokoro and one in Promani. Cash crops are mostly sold in the local market in Madiama, and regional markets of Jenné (26 km) and Mopti (90 km).

Central Mali is known throughout West Africa for its expansive dry season pasture lands in the Niger River Inland Delta (see figure 3.3), which draws herders, from all over the West Africa during the dry season. In the southern part of the Delta, known as Macina, Fulani herders dominate, while further north, Tuareg camel and donkey herders are more common. Because of the NRID's quality as a pasture resource in the long dry season, cattle are a major part of the regional economy and ecology. Most households in the Commune of Madiama have at least a couple of goats or sheep, sometimes dozens, and perhaps several working cows, depending on the degree of their wealth. The very wealthy in the commune of Madiama, including a couple of

[4] There are actually two types of groundnut grown. The South American domesticated peanut (*Arachis hypogaea*) that is common in the US is widely grown throughout Mali. The indigenous African variety, known in most literature as the Bambara groundnut (*Voandzia subterrania*), is also grown. The plants' physiologies are very similar and their cultivation practices are virtually identical. The peanut fetches approximately double the price as the Bambara groundnut in markets, as it is widely (and rightly, in my opinion) believed to be more palatable and culinarily versatile. This preference for peanuts over groundnuts is illustrated by the fact that the imported peanut is called *tiga* in Bambara and it is the indigenous groundnut that receives the name with a modifier, *tiganinkulu* (lit. peanut small ball).

Marka families, have herds of over 100 cows. Exceptions aside, the overall distribution of farming and herding activities varies substantially between the Fulani and the Marka, because of their unique historical niches in the human ecology of the area. Likewise the relationship between ethnic identity and subsistence strategies also differ greatly.

The average annual rainfall in this part of central Mali is approximately 600mm, though the entire region is noted for high interannual variability. Figure 3.4 shows some of this variability. 600mm is sufficient rainfall for rain-fed crops, when it is properly distributed throughout the growing season, but any less than that can lead to crop failure. 2000 was a year of small harvests and in 2002, most people in the Commune of Madiama never cut a single stalk. On the other hand, massive flooding occurred throughout the country in 2003 as the rainfall levels approached the old averages from the first half of the 20th Century. Despite widespread loss of crops due to excess flooding, no one complains about too much rain.

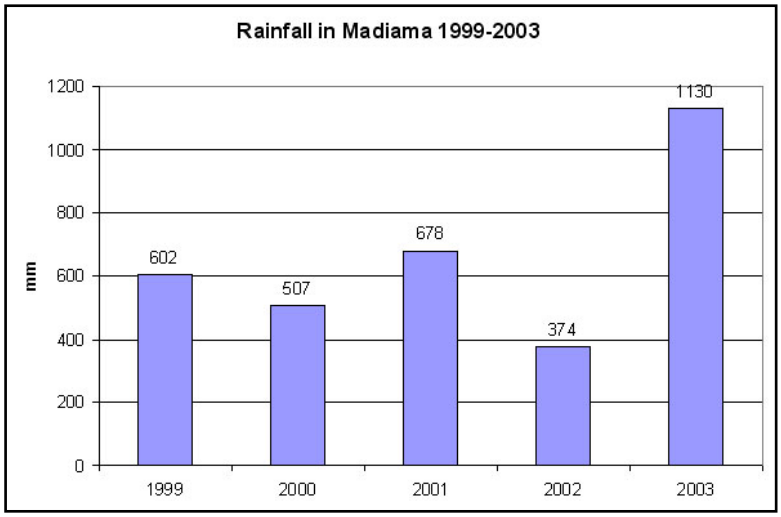


Figure 3.4 Rainfall in Madiama 1999-2003

Nearly all families in the Commune of Madiama have access to work cows and plows for traction and tillage, with a very small percentage of cultivation being done by hand, and even this often dictated by soil type rather than lack of access to equipment. Weeding is all done by hand with short-handled hoes. Fallowing, common in the past, is practiced very little at present because active fields occupy nearly all arable land within Madiama's territory.

Having extensified as far as possible, agriculture in Madiama is beginning to undergo intensification, with increasing reliance on organic inputs as the primary means of maintaining soil fertility in the annually-cultivated fields. Chemical fertilizers are available at the market in Madiama, but given financial constraints, they are used primarily on cash crops such as watermelons. There is no market for manure or compost, meaning organic fertilizers must either by generated within the household though the keeping of cattle, or deposited directly on fields by grazing cattle during the dry season. The Commune of Madiama itself has minimal pasture lands. The two areas that have recently been dedicated as pastures are of such poor quality and small size that the Fulani herders do not actually consider them proper pastures. These areas have crusted and rocky soils that are not well suited to cultivation and so have not been occupied by fields, making them pastures by default.

The Commune of Madiama borders the floodplains of the Bani River (see figures 3.3 and 3.4), which swells during the rainy seasons. The degree of the flooding varies with rainfall, but during most years it inundates a vast portion of the landscape, making the land suitable for the cultivation of wet rice (Figure 3.5). The NRID is a center of domestication for rice (*Oryza glaberima*) completely independent from the domestication of Asian rice (Andah 1993; Harlan 1993). Today, most of the flood zone between the Commune of Madiama and the main channel of the Bani River is actually property of the central government, which has built water-control dikes. These dikes serve the dual purposes of promoting rice cultivation and providing raised road beds for easier transportation. Rice fields are distributed in 1 hectare parcels by a government functionary who oversees the *casier*, or water-controlled rice floodplains.

The relationship of area to the river floodplain is evident in its name of the commune. Although the village is now largely a Marka village, the word “Madiama” is from the Bozo

language, meaning “Ma’s place”. The Bozo are an ethnicity whose place in the regional ecology is as fishermen in the highly productive Bani and Niger Rivers. Despite being 13 kilometers from the main channel of the Bani river, Madiama used to be a fishing village in the floodplain. It is still in living memory that the floodwater used to reach, and even surround, the villages of Madiama, Promani and Nouna. One informant, an elderly man, told me that in his childhood, people used to come to Madiama’s weekly market in dugout canoes, poling them all the way up to the village edge. This phenomenon has not been seen in decades due to declining rainfall.

Historical Human Ecology: The Long Durée in Brief

There has been dramatic irregularity and overall decline in rainfall in West Africa in recent decades. It has had a strong affect on all aspects of life in the Sahel, from the overall ecological stability to the poor human health and nutrition to the political economy of international development, food aid and famine relief. The causes for recent climate changes are debated[5], but a long view of West African ecological history reveals that major fluctuations are not new and have long impacted patterns of human behavior. Historical ecological research looking as far back as 30,000 years shows major climatological fluctuations, lasting decades, centuries and sometimes even millennia (Brooks 1986; Connah 1981; Grove 1993; Maley 1993). Scientific findings are supported by West African oral history, in which prolonged periods of regional drought figure importantly into legendary tales (Diop 1961; Niane 1965; Traoré 1989).

[5] From a local knowledge perspective, virtually all the rural people I spoke with in Mali accept that change in rainfall patterns is God’s will, so there is little to do about it other than pray for good rains. A few mentioned that development workers say that planting trees will also help bring the rains to an area, an idea introduced during anti-desertification tree-planting drives in the ‘80s and 90’s. People seem open to the idea, though I saw little sign that this notion has been deeply internalized into any local knowledge system. Either way, tree planting has become more prevalent in the Sahel over the last 20 years or so, more through external development funding than local initiatives. I only saw awareness of the idea that climate change may be tied to Northern industrial activities among educated individuals.

Pin-pointing the first hominid habitation in West Africa has been difficult, largely due to the degree of site disturbance and poor preservation conditions in the more humid south, where earliest occupations are believed to have been located. The very earliest estimations put occupation of the Sahara at around 1.0 mya. What can be said for certain is that a Late/Post-Acheulian technological complex, called the Sangoan, is found in West Africa, but dating it has proven problematic. Sangoan sites are usually located close to coastal or riverine environments and are heavily clustered in Ghana and Nigeria, with a few small assemblages found in Senegal and the Gambia. It has been suggested that the absence of known sites in other areas may be a function of where most archaeological research has been conducted and does not necessarily reveal actual distribution of hominid habitation (Phillipson 1993).

Evidence suggests that rainfall trends have fluctuated over the millennia, with several long periods that were significantly drier and wetter than the present. During the last glacial period in Europe and North America, from around 20,000 to 12,000 BP, northern Africa was significantly drier than at present, so dry that the edge of the Sahara Desert extended to 11° north of the equator, all the way to what is today southern Mali (the contemporary edge of the desert is usually reckoned to be around 15-16°). This time period is thought to have been so dry that the interior Sahara was probably devoid of human habitation (Brooks 1986).

Following this extremely dry period, evidence shows that there was a very prolonged wet period that lasted 7000 years, from around 11,000 BP until 4000 BP, during which a rainforest ecosystem spread up as far as 11° north of the equator. During this period, the interior of the Sahara was a lush grassland, dotted with shallow lakes, wetlands and waterways. The Sahara was populated by large herbivores and their predators: giraffes, aurochs, elephants, antelopes, and

lions, as well as lacustrine and riparian fauna, including hippopotami, alligators and shellfish. Many of these are portrayed in Saharan rock art found in areas that are far too arid today to support human or herbivore habitation (Brooks 1986; Muzzolini 1993).

During the wet period from 11,000 BP to 4000 BP that the Sahara came to be exploited by human populations, who appear to have entered the Sahara from both the Mediterranean north and the coastal south. Rock art found in contemporary Mali and Algeria, indicate a very humid, grassland environment that included animal husbandry as well as hunting and gathering (Muzzolini 1993). The archaeological record shows that by 6000 BP cattle pastoralism was present in the Sahara. Subsequent drying trends undoubtedly pushed herders further south, but this expansion was limited by the tsetse fly. Tsetse flies inhabit moister ecozones and spread deadly trypanosomiasis to cattle, effectively preventing herders from utilizing the more humid forest zones of coastal West Africa.

The prolonged humid period, during which the Sahara was a lush grassland, was interrupted by a 500-year drought in the middle, where average annual rainfalls dipped to levels even lower than modern levels. Although archaeological evidence points to intensive exploitation of wild grains by gatherers, the cultivation of grains is found to have begun around the end of the long, wet period between 4000 and 3000 BP. The major domesticates with West Africa origins are millet and rice. Rice is thought to have had several separate points of domestication even within West Africa, including one in the Niger River Inland Delta (Phillipson 1993). Jenné, only 26 km from Madiama, has been found to be one of the earliest sites with evidence for rice cultivation (McIntosh and McIntosh 1993). Sorghum, which is now widely cultivated across West Africa, originated in the eastern Sahara, in the area of Sudan and Chad

(Harlan 1993). Even today, rice, millet and sorghum constitute the most important grain crops in West Africa (with the relatively recent addition of maize in the more humid zones).

As agriculture spread across West Africa, a regional exchange network developed. There is evidence for long-distance exchange of raw materials, manufactured products and foodstuffs – including stone, iron, gold, pottery, dried fish, salt and kola nuts – as early as 1500 BC. The most important axis of trade is thought to have run from the coast to the inland. This intraregional trade was responsible for the rise in wealth and power of Ghana, the first West African empire[6] (Andah 1981). Control over long-distance trade with Morocco and beyond sustained Ghana's ascendance.

The origins of urbanism and state formation in West Africa used to be attributed to contact with North African and Arab traders, the racist implication being that sub-Saharan Africans could not have built empires of their own resource. The date for the *rise* of Ghana is uncertain, but it was already a wealthy and well-established political entity when north African traders arrived there in the 8th Century AD. Centered in what is now western Mali and southeastern Mauritania, the wealth of the empire was largely based on the rich gold fields found along the upper reaches of the Senegal River. Empires come and empires go, and Ghana fell in 1076, when its trade partners turned conquerors and its capital was overrun by the Moroccan Almorovids eager to gain control over the gold trade from the south (Niane 1989).

Ghana was not the only place where indigenous urbanism occurred in West Africa. McIntosh and McIntosh's (1993) excavations at Jenné-Jeno, only 26 km from the town of Madiama, show that there were indigenous forms of urbanism well before the arrival of Arab traders. Nestled on a seasonal island between the main channel of the Bani river to the east and a

[6] The modern nation of Ghana is far from the geographic locale of the ancient empire. The nation of Ghana took its name from the old empire for its prestige value as a symbol of African power and wealth, not because it actually claims any historical links with it.

secondary channel and vast floodplains to the west, Jenné-Jeno was initially settled around 250 BC by people who appear to have been already well versed in craft specialization, iron-working, rice agriculture and fishing. By approximately 500 AD, there is evidence of crowded cemeteries and extensive trade networks stretching out hundreds of kilometers, including into the Sahara Desert for salt and copper, mostly likely using the river as the conduit. This early exchange network formed the foundation for the long-standing and lucrative trade relationship with Timbuktu, at the northern end of the Niger River Inland Delta of the river. It is noteworthy that this early urbanization occurred outside of the context of any state-level organization (McIntosh and McIntosh 1993).

This trade route would eventually be extended by Arab traders from the north, starting in the 9th Century (Niane 1989). Through this channel, sub-Saharan West Africa would later receive many European goods, such as glass beads, cloth and other goods, by way of the trans-Saharan trade through Timbuktu. My research site of Madiama, being so close to Jenné-Jeno, was likely to have been connected to some to degree to the trade networks that ran through Jenné.

Islam reached sub-Saharan West Africa around 800 AD. Most early conversions to Islam were voluntarily. The earliest converts were generally urban ruling class and merchant class elites who had close contact with Arab and north African traders. For example, while although the court of Ghana did not adopt Islam, they welcomed Muslim traders from Morocco and many among the merchant class converted. The court of the kingdom of Gao, in what is now eastern Mali on the southbound part of the Niger bend, converted in 925. If simple exposure to Islam did not cause people to convert, there was also worldly incentive, as fellow Muslims gained preferred treatment from the foreign merchants who promised to be lucrative trade partners.

Islam also brought with it a powerful new practice that was particularly useful in commerce and governance: literacy (Curtin 1995a).

Throughout the Sahel and the Savannah, ethnic kingdoms ruled over their territories. The Mandingo kingdom was located in southern Mali between the headwaters of the Niger and Bani Rivers. In 1230, the Mandingo king Sundiata Keita began to establish the empire of Mali through military conquest of neighboring kingdoms. While provinces maintained somedegree of autonomy, Mali collected tribute from numerous kingdoms across West Africa that had been brought under a unified regime. At its apogee in 1325, the Malian Empire controlled and collected tribute from an immense expanse of territory, over 1300 km wide, stretching from the Atlantic coast (modern Senegal and southern Mauritania) in the west, the Manding Mountains in the south (modern Ivory Coast and Guinea), the mid-Sahara salt-mining outpost of Teghazza in the north, and the city of Gao in the east. The Malian Empire's wealth was solidly based on control of trans-Saharan trade in gold, kola nuts, ivory, slaves moving north and salt, glass beads, horses, and later guns, moving south. While Sundiata Keita himself converted to Islam in his lifetime, he made no attempt to impose Islam on his subjects (Niane 1989).

Although Arab traders and geographers had spread knowledge of sub-Saharan African civilization back to their homelands and beyond, the empire of Mali was further brought to the attention of the entire Muslim and Mediterranean world through the personage of emperor Mansa Musa. In 1325, Mansa Musa went on his religiously-mandated pilgrimage to Mecca. On his *hajj*, Mansa Musa brought slaves, courtiers and retainers said to number in the thousands. In an effort to show off the wealth and power of his empire, Mansa Musa brought and spent so much gold in Cairo, Egypt that it led to a depression in the value of gold which lasted for years. The wealth and prestige of Mali was firmly established in the world beyond the desert, and may

have spurred European interest in pursuing trading ventures along the West African coast, in an effort to avoid the Arab middlemen (Niane 1989).

The wealth, power and vastness of the empire of Mali has never been surpassed in West Africa. In the late 15th century, however, Mali began to go the way of the Ghana Empire, though it did not fall through the force of outside invaders. The empire of Mali instead disintegrated through the force of its own rebellious regional kingdoms, combined with political intrigues in the inner circles of power that ultimately weakened central authority. In the north and east, the Songhay kingdoms broke away, taking the key trading cities of Timbuktu and Gao with them, eventually stretching their power as far as Jenné. In the west (modern Senegal), a Wolof kingdom took its independence from Mali and the Fulani had risen up and established the theocratic Islamic kingdom of Futa Toro. Closer to its heartland, Mali was eventually eclipsed and absorbed by the rise of the non-Muslim Bambara kingdom based in the city of Segou. (Cissoko 1989; Ly-Tall 1989a).

As a central node in regional exchange networks, Jenné had long been a valuable city to have as a part of any kingdom. The area that is today the Commune of Madiama, being a satellite of Jenné, can be said to have gone the way of Jenné in terms of its incorporation into the regional imperial struggles. Jenné was, and still is, known as the southern port of entry into the NRID and an important commercial center linked with the trans-Saharan trade via Timbuktu, which as long been considered a sister-city with Jenné. After the fall of Mali, the southern delta area eventually became the frontier between the Songhay and Bambara kingdoms, suffering both as a battleground and a source of tribute and pillage for invaders from all sides.

> Agricultural populations in the Delta . . . were all tributary to the empire of Mali in 1494. From 1494 to 1590, these farmers were tributary to the Songhay empire; from 1590 to 1670, to the Moroccans; and from 1670 to 1810 were dependants of the Bambara kingdom in Segou (Cissé 1985).

During the 12th century, Fulani cattle herders began arriving in the southern Niger River Inland Delta area, known as Macina (or sometimes Massina), from Futa Toro in the Senegambia region. Fulani migration intensified sharply with the decline of Mali in the 15th century, (Niane 1989). Macina had long been a multiethnic region, with Bozo and Marka as the most numerous ethnicities, with significant Songhay, Bobo, and Bambara minorities. The Fulani were outsiders from the beginning in several senses. Not only were the Fulani recent arrivals in a long-inhabited area, but they were herders in a land of farmers and fishers. On top of that, the Fulani were, for the most part, Muslims in a rural landscape populated by animists.

Fulani herders intentionally limited their contact with farmers and fishers. However, they avoided contact with urban society even more. Although the ruling and merchant classes in cities like Jenné were also largely Muslim, their economic interests in getting a piece of Fulani wealth trumped their shared religious identity. As such, the Fulani wealth in cattle was heavily taxed and pillaged by Songhay, Moroccan and Bambara occupying forces. This pillage caused the Fulani to avoid unnecessary contact with urban society. Eventually, the centuries of harassment and taxation by ruling regimes provided the Fulani with economic motivation to organize, both politically and militarily (Batran 1989). Even more than ethnic identity, Islam provided the Fulani with an institutional and ideological structure through which to do so.

Throughout the second millennium, Islam had become increasingly common among West African rulers and merchants. However, most of the regular folk, the rural producers, maintained their traditional animist religions into the 19th Century. It was not until the 1800's that Islam spread across the general populous of West Africa through a series of *jihads*, mostly

instigated by militant Fulani clerics from Futa Toro in Senegal[7] (Boahen 1989; Curtin 1995b; Ly-Tall 1989b).

In 1818, Sekou Amadou began the Fulani uprising that lead to the foundation of the Dina, a theocratic Fulani kingdom based in Macina. The capital of the Dina, Hamdallaye (Arabic, lit. "thanks be to God"), was in a freshly built city on the border between the river floodplains and the highland pastures of the Dogon Plateau. Hamdallaye is about 25 km south-southeast of the contemporary regional capital of Mopti and approximately 70 km north-northeast from my field site of Madiama. The reign of the Dina was major turning point in regional history. When discussing local history with villagers, the Dina is typically the earliest reference point, most likely because it introduced several significant changes to the area. Local knowledge of this era and its influence on contemporary natural resource management is a theme that will be revisited in Chapters 5 and 7.

One of the most important impacts of the Dina on Macina was the mass conversion of the rural population to Islam. Many of these conversions were coerced and largely superficial, but it was the beginning of Islamicization of the countryside[8]. During the reign of the Dina, if the

[7] Futa Toro was actually the first of a series of revolutions in West Africa that were led by Fulani Muslim clerics, the last of which occurred in Macina. The success in Futa Toro gave rise to subsequent theocratic revolutions in Futa Jallon (northern Guinnea), Sokoto (northern Nigeria) and Liptako (eastern Burkina Faso), before arriving in Macina. Many warriors took part in several of these revolutions, traveling with their leaders to spread *jihad* across the region. Although the warriors, the *mujahadeen*, were of numerous ethnicities, the clerical leadership was nearly always Fulani. It is important to emphasize that the revolutions were not directed at non-Muslims. The political leadership of all of the locations listed above were already Muslim, but their claim to power was secular. The *jihads* were uprisings against secular chiefdom power structures in favor of installing a clerical ruling class who sought to govern according to the *shariya*. The *jihads* did not just signify a move toward Islam, but a move towards theocracy in societies that were already Muslim. In contrast to the Dina of Sekou Amadou, the Tukolor, led by Sekou Omar from Futa Jallon in Guinnea, was primarily directed against non-Muslim kingdoms (Ly-Tall, M.1989b).

[8] West African rulers who had converted to Islam had faced a quandary for centuries. Islamic law encourages, some would say requires, that pious and proper Muslim leaders rule their domains according to Islamic law. This is not an easy thing to do, however, when your subjects do not recognize the religion that underpins that law. Moreover, in rejecting traditional indigenous worldviews, many leaders were in effect rejecting the ideologies that had up to that point justified their own power, which was typically based on the principal that the ruling lineage had a special relationship with the land and the spirit world, a sort of 'divine right of kings' principle with a more diffused notion of divinity instead of the monotheistic one employed in Europe (Batran 1989; Cissoko 1989).

inhabitants of a village refused Islam, the village was often completely razed. This occurred to several villages within the Commune of Madiama. Some villages, such as Kessedougou, were rebuilt, while others are now lost to history. Despite the violence and destruction, Sekou Amadou is remembered favorably because he was responsible to bringing Islam to the population, who are now mostly Muslim.

Another important innovation introduced by the Dina was the rationalization of land management though the designation of ownership, management and exploitation rights of key resources. Foremost among these were the floodplain grasslands where the highly-valued bourgou (*Echinoloa stagnina*) grass grows[9] and secondarily the cattle paths (Ful. *burtol*, pl. *burti*) leading into and out of the NRID area. The first aspect of this rationalization was the establishment of the institution of the *jowro. Jowro* is a contraction of the Fulani words *jom wooro*, meaning "master of the village/lineage/collectivity". The leadership of the Dina conferred the position of *jowro* upon certain lineages after which it has been inherited patrilineally. After its establishment, the position was sometimes taken by other lineages through military force. *Jowros* exercise ownership over the bourgou pastures and are responsible for managing delineated administrative units (*leydi*) associated with them. As the Dina was a Fulani empire, the *jowros* have always been Fulanis. Consequently, the establishment of the *jowro* led to the practice of managing the NRID with a preference for the interests of pastoralists. Fishermen and farmers still retain some access rights to these areas, but their exploitation is subject to the approval of the *jowro*, who has the final say (Cissé 1985).

Another aspect of the rationalization of natural resource management by the Dina was the establishment of the *burti* (Fulani, sing. *burtol*, designated paths along which cattle enter and exit

[9] *Bourgou* is the French appellation, drawing from the Bambara name, *burugu*. The Fulani name for this species is *gamaraje*.

the interior floodplains) system, which institutionalized established cattle paths for the entry and exit of cattle from the NRID. The establishment of officially designated paths marked the delineation of agricultural spaces and pastoral spaces in an effort to reduce overlap and conflict between the user groups. The Dina's rationalization of natural resource management established rules and conventions by which floodplain pastures and associated resources in the NRID could be exploited. Not only did the Dina designate spaces for the passage of herds in and out of the NRID, but it also formalized many customs relating to transhumance. The custom of controlling the entry and exit of herds from the bourgou pastures dates back to the time of the Dina. Each *jowro* was responsible for determining the date of entry into his land. The custom was for the herd owned by the *jowro* himself to lead the entry into his land. Other herders had to pay some sort of fee in order to enter. If any herder went in advance of the *jowro*'s herd, he would be punished by the Dina and probably banished by the *jowro*. The Dina was renowned for strict enforcement of the rules and severe punishment for those who broke them (Cissé 1985; Ly-Tall 1989b). This system of the *jowros* controlling the descent of the herds into the delta continues to this day, in spite of government attempts to have a hand in the process.

By putting power over land use into the hands of Fulani herder/administrators, the Dina was effectively enacting a discursive power play. Inasmuch as Fulani favor herding over other subsistence activities, the institutionalization of the *jowros* by the Dina defined the interior of the delta as a pasture space. The interior of the delta could just have easily been defined as a space primarily for fishing grounds or rice fields, but under the Dina, these production activities were marginalized.

Being at the edge of the NRID, Madiama does not have any substantial bourgou pastures thus no *jowros*. Madiama is, however, the site of one or two *burti.* I say one or two because the

paths are contested spaces. They are under increasing pressure from agricultural encroachment and authority over them is uncertain. These topics will be addressed in Chapters 5 and 8. At this point, I simply want to emphasize the Dina's efforts at rationalizing natural resource management. While most of the *burti* still exist and are widely recognized, they, like many pastures, are subject to increasing pressure from farmers who seek to clear fields in these spaces that receive so much cattle manure every year. As one informant put it, "It used to be that the cattle walked to the fields. Now the fields walk to the cattle".

Until the 19th, and some might say 20th, Century, slavery had been a fact of life in West Africa for all known history. Arab geographers found that the kingdoms of West Africa maintained large retinues of slaves. Early Arab traders dealt in slaves as well as other valuable commodities. There is some suggestion that the trans-Saharan slave trade may go back as far as the Roman era, though this would have been on a very limited scale (Masonen 1997). The brutality and inhumanity inherent in the indigenous slave-trading system paled in comparison to that which was created by the European slave trade. The massive scale of the slave trade with Europe had equally massive impacts upon West African societies, socially, politically and economically.

Portuguese trade ships first reached the Gambian west coast of Africa in 1441 gradually making their way around to the southern coast of West Africa by 1486. The Portuguese even sent embassies to the Empire of Mali (Niane 1989). It has been estimated that by 1500, 25% of the gold leaving West Africa, left on Portuguese ships. This began the era of direct exchange between European and sub-Saharan Africans, what tragically became the slave trade era. The Portuguese brought linen, wool, mirrors, blades, pewter, dishes and beads to exchange for gold, spices, timber, gum, ebony, ivory, amber, crystal, ostrich feathers and slaves. Initially, the slave

trade was of tertiary importance. It was not until the 1600s that the slave trade really boomed. Demand for slaves in the plantations and mines of the Americas skyrocketed, and so demand for slaves from West Africa skyrocketed as well. Perhaps uncoincidentally, this is also when the French, English and Dutch began to show significant interest in direct commerce with sub-Saharan Africa (Oliver and Atmore 2001).

Prior to direct European contact, virtually all trade destined for outside the region was trans-Saharan, directing economic and political power in West Africa northward. This is why the largest early kingdoms were found in the Sahel. The fluorescence of European trade along the southern coast of West Africa gradually turned the economic geography of the region on its head and stimulated the rapid centralization of political organization along the coast. Until the 1500's, the greatest political complexity along coastal West Africa had taken the form of small city states, but had not been unified into any level of organization comparable to that found in Sahelian West Africa. In the bigger geopolitical picture, the Sahelian empires were major powers while coastal West Africa was a backwater. This can be attributed to several factors already mentioned. First of all, the presence of tsetse flies kept out the vehicles of effective long distance trade, namely horses and camels. Secondly, the primary long-distance trade partners were to the north. Any northward trade coastal West Africans wanted to conduct would have had to go through the Sahel, giving societies there a distinct economic advantage due to their geographic setting (Curtin 1995c; Oliver and Atmore 2001).

The disintegration of the empire of Mali by the 16th century created a time of social turbulence across the region, a time when slave raiding was made easier by lack of strong authorities. The Asante, Dahomey, Oyo and Benin kingdoms along the southern coast of West Africa conducted slave raids on their northern neighbors and traded for slaves from even further

north, sometimes more than 1000 km inland. As the industrial revolution began in England, Africa became a dumping ground for English manufactured goods in an effort to procure ever more slaves for sale in the Americas. By the end of the 1700's, some areas of West Africa were vastly depopulated by slave raiding from both the coast and from the north for the Sahelian-Arab slave trade. Not only did this lead to political instability, but it also led to a shortage of human "product", increasing the violence and scope of slave raiding (Curtin 1995c).

The coastal states of Asante, Dahomey, Oyo and Benin (in modern Ghana, Benin, Togo and Nigeria) had all solidified by 1600, but came nowhere near to approaching the size or power of prior or contemporary Sahelian empires. The formation of these coastal states was stimulated by their lucrative economic contact with Europeans. Although the inland, Sahelian empires remained powerful, increasing trade with Europeans on the coast gave rise to competing regional political and economic powers, which slowly diminished the Trans-Saharan exchange (Curtin 1995c; Oliver and Atmore 2001).

In the NRID, the conquest of the Dina by the Tukolor, led by Sekou Omar Tal of Guinea, is remembered as a time of great social upheaval and insecurity. The Dina had been very strict, but it was also highly ordered and stable. In the Mid 19th century, the Tukolor, Fulani from what is now northern Guinnea, successfully undertook *jihads* against the animist Bambara kingdoms of Kaarta and Segou, just to the south and west of Macina. The Dina, like the Tukolor, was both Muslim and overwhelmingly Fulani. Despite these shared qualities, the unwillingness of the leadership of the Dina to join the Tukolor as subservient partners, led to military conflict between them and the ultimate demise of the Dina. During the rule of the Tukolor in Macina, from 1862 until the 1890's, there was little in the way of systematic governance. Instead, the

mujahadeen armies of the Tukolor continuously pillaged vanquished populations, robbing them of harvested grain, cattle, and sometimes even their own liberty (Ly-Tall 1989b).

One informant of mine, an old man, recalled that his father was captured by Tukolor cavalrymen near Segou, hundreds of kilometers away, and brought to the around of Madiama where he spent his life as a Fulani's slave. This same man recollects the stories of his elders, who indicated that there was relief when the French colonial forces took control of the area, because it at least squelched the chaos, social instability and uncertainty that had reigned for prior decades under the Tukolor.

As a nation-state, Mali has its early origins in the Berlin Conference of 1884, during which European colonial powers carved up of a map of Africa and allotted certain designated portions to the signatories. The largest single region that came out of the Berlin Conference was the French Sudan, an administrative unit that cut a swath across the entire Sahel, reaching from Senegal to Chad, from Mauritania to Ivory Coast. Following the general upheaval associated with the slave-trade era, and the reign of the Tukolors in the delta, French conquest ironically brought an era of relative peace. Although the peace was brought about through progressive conquest and pacification of various kingdoms in the region, and later entailed forced labor, it is still often recalled as an era of reduced upheaval. The Berlin Conference also established an international (European) prohibition of slavery. Consequently, under French rule, slavery was officially outlawed in the French Sudan. Despite the ban, slavery persisted though institutional and social momentum such that the first post-colonial government saw fit to outlaw it again.

My informants explained that the French let traditional power land tenure systems stand, at least as they pertained to settled agricultural lands. The French also maintained the system of procedures governing the descent of the herds into the delta. However, the French radically

changed governance of non-agricultural rural exploitation. In 1935, the colonial administration declared that "*terres sans maitres*", land without owners, belonged to the public domain, meaning the state. Under this legal approach, derived from the Napoleonic civil codes of the early 19th century, legal ownership of the land could only be gained through putting it into agricultural production. Forests and pastures were considered lands without owners, because they had not been put into production. In the eyes of the French administration, forestry and herding were considered extractive exploitation, but they did not "improve" the land through intentional and directed transformation for the purposes of economic production. The rationale behind this type of legislation was the protection of the environment from the abusive exploitation by rural people, who were perceived as causing environmental degradation (Benjaminsen 1997), a colonial discourse that has since come under great scrutiny and criticism (Fairhead and Leach 1995; Fairhead and Leach 1996; Leach 2000).

Uncoincidentally, the Forest Service (*Le Service des Eaux et Forêts*, usually known simply as *Eaux et Forêts*) was also established in 1935 in order to govern public domain lands and provide extension services to rural people. It is telling that many of the agents for the new forest service were recruited from the military and the police forces. Forestry agents served to regulate rural resource exploitation in non-agricultural spaces, including the transformation of "wild" areas to fields. The codes and their enforcement have become increasingly draconian over the years, gradually causing the Forest Service to earn the animosity of rural people across the country (Benjaminsen 1997). Since democratization, the power of the Forest Service has diminished somewhat. Even today, although an agent of the forest service is officially supposed to approve the opening of any new fields, it is widely acknowledged that this procedure is rarely followed.

Another significant change that occurred in Madiama during the colonial era was the introduction of the plow and cart. Multiple informants indicated that within the Commune of Madiama, the plow was introduced around 1950 in a forced, top-down fashion. Despite initial reluctance, use of the plow quickly proliferated, permitting agriculture to become more spatially extensive. Beginning at this time, the spread of large fields throughout the landscape set the stage for increased conflict between herders and farmers over land use and land management.

In 1960, the French government granted independence to the French Sudan, which subsequently broke up into Mali, Upper Volta (now Burkina Faso), Senegal, Ivory Coast, Dahomey (Benin) and Mauritania. The first ruler of independent Mali was Modibo Keita, who undertook socialist economic reforms and forged close links with Maoist China. Kieta's regime did not significantly alter rural production practices.

General Moussa Traoré overthrew Keita in 1968, beginning a 23 year term as military dictator. Traoré's regime was notoriously oppressive, with a wide network of informants who identified dissenters and punished them severely. This severity affected many aspects of rural production. The Forestry Agency created under the colonial regime continued their close control over rural land-use and severe punishment of rule-breakers. During the Traoré era, transhumance in and out of the NRID was highly monitored by government agents. Veterinarians employed by the state, checked on herds' health and the state of pastures in order to determine dates for the transhumance. Although these veterinarians were employed by the state, they are widely acknowledged to have been better paid by the herders themselves in order to facilitate the movement of herds on the dates preferred by the herders.

Since the non-violent overthrow of Traoré in 1991, Mali has been a multi-party democracy. Their first elected president was Alpha Oumar Konaré, who served two five-year

terms. During this era, Mali experienced its only violent internal strife, in the form of a low-grade rebellion by the Tuaregs, largely nomadic herders in the far north and east of Mali. Their complaint was that the government had too strong of a sedentarist and southern-bias. A peace was negotiated in 1996, by then Amadou Toumani Touré, who was then a general in the Malian army. Touré has more recently been elected president following Konaré, who has gone on to become the president of the African Union (Lode 1997; Vengroff 1993).

Since the recent advent of democracy in 1992, there has been a trend toward decentralization of political power, which is theoretically devolving authority away from the central government and back into local administrative bodies. Policies of decentralization are not unique to Mali, but are part of a trend across Francophone West Africa, where the central governments tend to be weak, poorly funded and poorly situated to contribute to to management of local affairs (Painter, et al. 1994). There is still some question about the degree to which power will truly rest in local hands or whether it will simply become a localization of the central government (Benjaminsen 1997), wherein locally elected officials would be responsible for enforcing centrally-determined policies.

The move toward political decentralization has been connected to, and is now virtually indistinguishable from, a natural resource management perspective known as the "*approche terroir*" (surrounding territory) in French. The premise is that natural resources will be more sustainably managed when authority for their management rests among the users of those resources. Under the approche terroir, each village has responsibility to manage its territory (*terroir*) as it sees fit. A village's territory is defined through customary tenure practices, which are backed by law. One major problem with this approach is that "action spaces", the spatial

range upon which individuals and villages make their living, often do not correlate with the boundaries of village territory.

Throughout the Sahel, and particularly in the NRID, it is not uncommon for much rural economic behavior, such as farming, fishing or herding, to be done well outside of one's village territory. Consequently, a policy that is supposed to improve natural resource management though increasing natural resource tenure may be having the opposite effect, destabilizing people's rights to use certain spaces that they are accustomed to using and upon which they are reliant (Painter, et al. 1994). Such effects are not evenly distributed across production sectors. Pastoralism in Mali, which is the most geographically extensive production strategy (compared to farming and fishing), has an action space that stretches across the entire region. In fact, it is almost beside the point to discuss "pastoralism in Mali" when so many of the herders who the NRID are not from Mali, and many Malian herders travel across national boundaries for parts of the year[10]. Pastoralism is often less heedful of national boundaries than ecological zones (Scott 1998). However, my research indicates that in Madiama, local Fulani feel a sense of ownership, or at least greater rights, over local pasture resources in relation to non-local Fulani herders who come to use them, and there is conflict between local and foreign Fulani, though some claim it is of a different character than conflicts between local Fulani and local Marka.

Currently, Mali is divided into five administrative levels. The national level, the regional level, the circle, the *arrondissement* and the commune. Each of the 8 regions is named after its capital city, as shown on on Figure 5. The communes, which can be no smaller than 10,000 inhabitants, are recent political creations since the advent of democracy. The legislation that

[10] All of the nations of Francophone West Africa who are members of the West African Economic and Monetary Union (Union Economique et Monetaire de Afrique Occidental, UEMAO) have open borders and share a common currency with other members. These nations are Benin, Burkina Faso, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal and Togo.

brought the communes into existence did so in preparation for phasing out the *arrondissements*, which typically contain 2-3 communes. After establishing the boundaries of the communes, the first local elections were held in 2000, and the second in 2005. Mali has a parliamentary system in which people vote for parties, who then gain a proportional number of seats. At the local level, the Communal Council is comprised of nine members, who then elect the mayor of the commune from within their ranks. With the exception of the commune, administrators at every other level are appointees of the central government. While the creation of the communes and the election of local officials is meant to give rural people a voice in the management of local affairs, it also brings the central government closer to rural people, putting a local face on the introduction and enforcement of federal policies. Under the new decentralization policies, local governments are responsible for managing an increasing number of local affairs, including natural resource management, tracking civil statistics such as births, deaths and marriages, and local development in general. One major aspect of this is that the communal government (the Communal Council and the Mayor) are responsible for levying and collecting taxes from their constituents. Under the regime of decentralization, households[11] are taxed based on two aspects. First, they are taxed according to the number of *imposables* in the household. Not everyone qualifies as a taxable member of the household according to Malian law. Children under 14, women who have had four or more children and anyone over the age of 55 are excluded from taxation. Everyone else is considered an economically productive member of the household and for whom the government exacts a tax of1000 CFA[12].

The second aspect of the household that is taxed is capital possessions. These include cows (250 CFA), goats and sheep (50 CFA), donkeys (100 CFA), horses (800 CFA), and

[11] See Chapter 5 for a discussion of what constitutes a household, both from a legal and cultural perspective.
[12] The value of the CFA, the West African franc, is fixed to the value of the euro, having previously been fixed to the French franc. In spring of 2005, the exchange rate was approximately $1 = 500 CFA.

traditional firearms (hand-made by blacksmiths 625 CFA), and modern firearms (industrially made, 5000 CFA). Vehicles are taxed individually rather than as a part of the household tax. It should be noted that these capital possessions are reported by the owners and are never verified by authorities. While I cannot speak to conditions in other communes, in Madiama, gross underreporting is widely acknowledged to be the norm, particularly among the largest cattle owners, and collection has been very contentious process among nearly everyone. Under the contemporary political regime of decentralization, the majority of taxes collected at the communal level are kept at the communal level and are intended to be put toward the commune's development by the mayor and his counselors.

Sustainable Agriculture and Natural Resource Management

A final and important aspect of my research site is the way that it came to be my research site. I have had the good fortune of conducting my research as part of an international, multidisciplinary team that was doing applied research. I initially arrived in Madiama through being a part of the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM-CRSP), which was funded by United States Agency for International Development (USAID). My introduction to the community was greatly facilitated by my association with SANREM, which was active in the commune from 1998 until 2004.

SANREM represents the American government's response to the Brundtland report and the 1992 Rio Earth Summit, which called for public and private entities, governments, corporations and NGOs to work toward sustainable agriculture and environmental conservation in the interests of human health at the local and global scales. Unlike most of USAID's work, SANREM is not a development project as such, but a research project on integrative and participatory methods that would generate a new approach to development. The goal of this new

approach is to simultaneously meet human needs and maintain ecological stability; in other words, achieve sustainability.

> The [SANREM] research approach must take into account those factors that influence the ability of people to improve their livelihood, income and health. It must make use of and strengthen existing pools of indigenous knowledge available for the design and adoption of sustainable production systems. Research projects should seek to understand how physical, biological, economic, and social factors interact and must be balanced to manage agroecosystems in a sustainable manner (Council 1991).

> SANREM would advance the principles, methods, research, and collaborative breakthroughs for a new paradigm which would rise to the challenges outlined in the Brundtland Report. SANREM was designed to carry out basic and applied research on sustainable agriculture and natural resource management across multiple scales involving local people, NGOs and government agencies and universities (Rhoades 2001:4).

SANREM's initial three research sites were selected from three continents and cover different ecological zones. In South America, Ecuador was chosen to represent mountainous areas. In southeast Asia, the Philippines was chosen to represent lowland tropical areas. In West Africa, Mali was selected to represent arid-land areas.

My affiliation with an established project meant that my research was done in conjunction with sociologists, botanists, agronomists, agricultural economists, pasture ecology researchers, conflict management consultants, and large animal veterinarians who were a part of the SANREM team. Malian researchers were all from the Regional Center for Agronomic Research (CRRA) in Mopti, which is a part of the Malian national Institute of Rural Economy (IER) and SANREM's national research partner. IER is the branch of the Malian national government that supports applied scientific research on agriculture, pastoralism and fishing. Far from being the lone anthropologist conducting research on remote people in isolation from the outside world, my field work stays were frequently punctuated by short visits from other SANREM researchers, providing me an opportunity for cross-disciplinary engagement with my colleagues and a broader perspective on the project as a whole.

In order to provide some context for my own research, I will here provide a very brief synopsis of SANREM as a whole and the specific activities undertaken by the project during its five years in Madiama. This summary should be taken as a broad overview rather than a comprehensive summary of the project. Those interested more details should refer to the book published by SANREM-Mali, entitled *Conflict, Social Capital and Managing Natural Resources: A West African Case Study* (Moore 2005).

After the Commune of Madiama was identified as the site in which SANREM wanted to work, SANREM researchers conducted a Participatory Landscape/Lifescape Appraisal (PLLA) in three villages. The goals of the PLLAs were to identify links between available natural resources, food security and poverty; assess historical and extant natural resource management practices as well as related conflicts; and to identify and prioritize the research and training needs of the residents. The PLLA was the baseline reference for the rest of SANREM, enabling researchers to understand natural resource management in Madiama and the issues that were the most important to its residents. The results of the PLLA highlighted several major natural resource management concerns across three villages: declining soil fertility, lack of adequate pasture or fodder for local herds, intensifying conflicts between herders and farmers, inadequate or unreliable flooding of the irrigated rice production zone Ultimately, most issues pointed back to food insecurity as a fundamental underlying problem. (Earl and Kodio 2005).

SANREM's approach was to design research addressing the needs identified by Madiama's residents, and to increase their capacity to enact new natural resource management strategies and diffuse information to the citizens of the commune. In order to create a solid social foundation for the coordination of local development and to facilitate communication between researchers and citizens, SANREM and the local authorities oversaw the establishment of the

Natural Resource Management Advisory Committee (NRMAC), which has representatives from every village in the commune and serves to advise the Mayor on natural resource management issues. NRMAC representatives are elected by village-level associations and are expected to report back to them to distribute information.

SANREM's goal of reinforcing local capacity to in sustainably manage natural resources is synergistic with the '*approche terroir*' recently instituted in Mali, where decentralization of power has given political rights of management to local populations. SANREM sought to provide conceptual, technical, and organizational tools to reinforce the capacity of the local population to arrest and reverse natural resource degradation, while meeting human needs for food security and economic income.

The establishment of the NRMAC was fundamental to reaching the goal of increasing social capital between the residents of the different villages in the Commune of Madiama. The very notion of the commune as a local administrative unit is new in Mali and only arrived just prior to SANREM. Consequently, there had never been any *official* institutional links between the villages of what is now the Commune of Madiama. There had been social contacts, intermarriages, etc., but the notion that these 12 villages formed a collective group that should function as a whole is very new. Consequently, institutional links between the villages as a whole were weak. This weakness was addressed by building social capital between villages and villagers, increasing the degree to which they know and value the opinions, needs and well being of each other. Increased social capital provides greater incentive to cooperate in the development of the commune as a whole (Moore 2005; Moore and Cissé 2005; Moore, et al. 2005).

Several different research projects and interventions were conducted by Malian and American-based researchers as a part of SANREM in an effort to address the locally-identified

needs in Madiama. In order to provide a solid foundation, descriptive scientific studies were conducted in Madiama in order to characterize the soils (from a soil science perspective) (Badini and Dioni 2005), quantify the movement of cow, sheep and goat herds through the commune during the annual transhumance (Ballo and Outtara 2005), and to gauge the land use changes in Madiama between 1952 and 2002 (Wynne, et al. 2005). A Social Accounting Matrix (SAM) study was conducted in order to model sectoral linkages in the local economy and identify sectors in which increased activity would have the greatest ripple effect throughout the commune. The results indicated that the greatest multiplier effects were to be found in rice and livestock production, including cows, goats, sheep and poultry (Brewster, et al. 2005). All of the aforementioned research served to establish a quantitative baseline of ecological and economic conditions in Madiama and to compliment the qualitative data gathered through the PLLA. In order to increase the capacity of the NRMAC to address natural resource management issues and function as an effective body, a series of educational workshops trained them in basic skills. These workshops included fundamental topics such as literacy, numeracy (mathematics and accounting), relevant natural resource and decentralization laws.

The NRMAC was trained in Holistic Management®[13] (HM) during a 5-day workshop in 1999 and two test pastures were established for its implementation. HM posits that pasture degradation is not a function of number of animals on a pasture, but the amount of time they are permitted to spend in any given area within that pasture. Consequently, HM proposes that a degraded pasture can recover even with a large number of animals on it, if rotational grazing is practiced. The 'holistic' part of HM comes from the notion that the pastures are not be managed for a single outcome, but for overall ecological health and productivity, and its management also

[13] Holistic Management, capitalized, is a strictly defined brand name pasture management model developed by the Allan Savory Center for Holistic Management.

needs to consider culturally contingent priorities (Bingham 2005). After delimiting the test sites, the NRMAC established management rules and identified villagers who were to oversee the sites and enforce the established management regulation. These on-site managers informed herders who were not from the area of the rules and persuaded them to cooperate, which by the managers accounts, was generally well-received.

Farmer-herder conflicts are common in the NRID and had been cited a serious problem in Madiama during the PLLA. Consequently, a series of conflict management training workshops were conducted over several years. These workshops, conducted by an American who is a conflict resolution consultant, was aimed at giving the farmers and herders of the commune of Madiama the conceptual and practical skills to avoid and diffuse conflicts between them. Participants in the workshops included NRMAC members and dozens of villagers from whichever village was hosting the workshop that year (Goebel, et al. 2005). However, the conflict management skills learned in the workshops were not unique to natural resource management conflicts. Instead, they are applicable, and indeed were applied, in many other contexts, from conflicts within a household to conflicts between households to conflicts between villages.

SANREM researchers conducted controlled grazing experiments in which sheep were picketed in enclosed pastures. Each sheep had its own pasture section with eight pickets, so that they could be rotated in an eight step cycle. The variable that determined how often the sheep would be rotated was height of forage grasses. The objective was to measure how grass species responded to different degrees of grazing pressure, while simultaneously measuring the growth of the sheep. By measuring both grass and sheep responses to the experiment, a model of controlled grazing management regimes was developed to predict how degraded pastures could

be improved while continuing to be exploited by animals. Findings show that when forage was grazed down to 3 cm, there was a shift in plant species over time. The more desirable forage species did not regenerate quickly and there was an increase in invasive species (esp. *Cassia tora*) that are of marginal benefit as forage. When sheep were only permitted to graze down to 6 cm, grass regeneration was significantly better and species composition did not shift toward invasive species such as *Cassia tora* (Abaye, et al. 2005). The adoption of this technique would represent a major intensification of pastoralism, in that it requires a great deal of attention to details.

One of the primary concerns cited by the residents of Madiama in the PLLA was declining soil fertility. Fallowing is decreasing in Madiama, as demands on the land have grown along with the population. Reduced rainfall, which decreases overall biological productivity, has compounded this problem. In response to this, the agronomist working with SANREM conducted numerous field trials of soil fertility management regimes. All of these trials were conducted in upland rain-fed fields, where soil fertility decline is most acute. Techniques tested included millet-cowpea rotation, application of small ruminant manure, application of cow manure, and several variations of microdosing[14] chemical fertilizers (Badini, et al. 2005). In addition to their biophysical efficacy, the techniques were also analyzed in terms of their economic efficiency, the relative payoff for degree of labor and capital outlay (Wyeth, et al. 2005).

After having listed all of the useful research and skills training that has been conducted in and for the residents of Madiama, there is one more research project left to mention: my own. In

[14] Microdosing involves placing a small, measured quantity of fertilizer in immediate approximation to the seeds/sprouts. This can be done at the same time as planting or a short while after germination. The theory behind microdosing is that it is a more efficient and effective use of chemical fertilizer than broadcasting it over a field, thus making it possible to see significant results with smaller amounts of fertilizer, making it more affordable to peasant farmers.

multi-year, interdisciplinary projects, social scientists can do the most effective research when they start their research in early phases, allowing their findings to inform and guide subsequent stages (Rhoades 1984). My research would have been more useful to the overall SANREM project if it had been undertaken at the very beginning. This would have allowed it to be fully processed and shared with my colleagues while their work was still underway. Unfortunately, the bulk of my research with SANREM didn't start until 2003, when the project was approaching its completion. This was not the result of poor planning on anyone's part, it was just the chance timing of when my path through graduate school intersected with SANREM's research cycle. I realized that most of my findings would only be written up after SANREM was over, and so would not be as useful to the other researchers and the people of Madiama as they could have been. However, I decided to go forth in the same fashion as I would have if I'd been conducting my research at the beginning of the project.

One of the most immediate effects I had on others' research was the result of my pilot study in 2001. I found that area farmers ranked small ruminant manure as having a greater impact on soil fertility, more "force" (*fanga*), than cow manure. I did my pilot study during the first year of the aforementioned soil fertility field trials. My ethnographic data convinced the agronomist to include small ruminant manure trials in his experiment, which had previously only included cow manure and chemical fertilizers. The results of his research confirmed the local knowledge, in part, by finding that a smaller amount of small ruminant manure was as efficacious as larger quantities of cow manure. I say only a part of the local knowledge was confirmed because the common characterization of small ruminant manure is that it "lasts in the soil" for as long as 5-7 years. Unfortunately, data from the field trials was not taken for that long.

Aside from the research technicians, who lived in Madiama for four years and participated in virtually every aspect of the project, including mine, I was the only SANREM researcher who spent long spans of time in Madiama. I went out in the field with several of the researchers mentioned above to see their projects first-hand and to document how their projects articulated with local experience on the ground. These experiences afforded me the opportunity to learn about the project as a whole, to work alongside the other researchers and to learn about development through personal experience., I acted as "cultural broker" whenever possible, sharing what insights I could in order to help my colleagues' research articulate with the local milieu. I even participated as a translator (English to French/Bambara) for one day of a conflict resolution workshop. For me, participant observation was not just something I did with the locals, it was something I did in all aspects of the SANREM project.

CHAPTER 4

METHODOLOGIES

The research presented here was conducted over the course of three trips to Mali, totaling 17 months in country. I conducted preliminary research on local knowledge of soils during three months in the summer of 2001. Later, I spent 8 months in Mali, from June 2003 to March 2004 and another 6 months from September 2004 to March 2005. My research was conducted as a part of the West Africa branch of the Sustainable Agriculture and Natural Resource Management (SANREM) program of the United States Agency for International Development (US-AID).

My introduction to the community was facilitated by my participation in a project that was already underway and already had an established local presence. My primary contacts in the community were the members of the local Natural Resource Management Advisory Committee (NRMAC), which is comprised of representatives from each of the villages in the commune of Madiama. I was first introduced to the NRMAC at one of their monthly meetings. As I spoke Bambara and was going to be spending a long span of time in the community, the committee decided that I needed to take on a local name. I received the first name of the vice president, Moussa, and the last name of the president Sao. Under the moniker Moussa Sao, I began my fieldwork in the Commune of Madiama. While I developed many relationships independent of the NRMAC members, the NRMAC representatives provided me with an introduction to each of their villages and their residents.

One of the challenges of doing integrative research is that data comes from a variety of sources and through a variety of methods. In order to elicit all of the diverse information I

sought, I employed a wide range of data-collection methods. Following on my original research intentions, I used the ethnoecological survey as a cornerstone of my research. This survey was primarily directed at local knowledge of soil. While the core of my research is founded in ethnoecological interviews, there are several other forms of data that inform the results of the ethnoecological interviews and expand the breadth of my work.

It should go without saying that I engaged in participant observation. This ranged from farming and herding to attending meetings at the mayor's office regarding NRM and other topics. I also engaged in participant observation of development efforts at a number of levels, including the activities of other SANREM researchers, local committee meetings and some of the activities of an independent development NGO dedicated exclusively to Madiama. I also engaged in a wide variety of key informant interviews covering land management practices, farmer-herder relations, natural resource conflicts, ethnic identity, NRM politics and development. My key informants included local farmers and herders, NRMAC members, government officials at the local, circle and regional levels, and development professionals. Following a brief discussion of methodological concerns, I will discuss each of these methodologies and their execution in greater detail.

Methodological concerns

In theory, doing a local knowledge study in a development context could be considered problematic, as a major goal of SANREM was to augment local knowledge with experimental research findings and institutional reinforcement. Mine is not an impact study, documenting local knowledge before and after SANREM interventions. Rather, it was conducted concurrently with all of the other research, and as such, may theoretically have been affected by the introduction of new ideas during the course of my research. There are three factors that mitigated this concern.

First, all indicators show that diffusion of findings was a significant weakness of the NRMAC, thus there was little worry of other research findings skewing my data. The committee itself even acknowledged that this was one of their greatest shortcomings. Most of the people in the sample used for the ethnoecology interviews claimed to have little or no knowledge of the NRMAC and their activities (this was the topic of the first question). Besides, knowledge systems have been shown to change gradually, with or without research data.

Secondly, my local knowledge research contributed to one of the experiments, providing a positive feedback between local and scientific knowledge. To put the example in brief, one of my early findings was that interviewees overwhelmingly percieved goat and sheep manure to be a stronger fertilizer than cow manure. The SANREM agronomist picked up on this finding and then integrated the comparison into his experiments, ultimately verifying the observation (Traoré 2005). The benefits of this kind of positive integration of local knowledge and scientific research outweigh any negative affects it may have had on the stability of the knowledge system that I was investigating. Looking at it from a strictly scientific methodological angle, this situation may not directly offset the concern of the agronomic research skewing my anthropological data, but such trade-offs are a necessity in participatory research, wherein methodological rigor is balanced with the desire to make a difference on the ground. If there has been any trade-off of reduced methodological rigor for increased efficacy of research in Madiama, I see that as an exchange worth making.

Finally, it would have been impossible for other researchers' findings to skew my data. As discussed in Chapter 2, I treat local knowledge simply as knowledge that is held locally, regardless of it provenance. If concurrent research had somehow affected local farmers and herders in such a way as to include a new idea in the local knowledge system, so be it.

Knowledge systems are dynamic by nature and never complete. The inclusion of even a recently introduced or adopted idea would still have reflected the state of local knowledge at the time when my research was conducted, and that was my goal.

Participant Observation

As with most anthropological research, participant observation was a central part of my research experience. In addition to my formal research interviews, I herded goats, harvested sorghum and millet, attended meetings of the association with which was working, shot the breeze over copious amounts of tea, attended civic meetings (especially, but no limited to, the management of the descent of herds from highlands into the floodplain) at the communal, circle and regional levels, fasted for the entire month of Ramadan in 2003 and half of 2004, conversed with people in front of the general store in Madiama and in numerous private courtyards throughout the commune. Sometimes, my research topics were explicitly addressed and sometimes conversations just meandered according to their own momentum. In short, I participated to the best of my ability in the day to day and seasonal aspects of life, as well as in official functions that were relevant to my research topic. Participant observation provided me with several social contacts and local-perspective insights into my research topic that would not have readily arisen in formal interviews. It also gave me a tremendous education in the general cultural context in which my research topic was situated. Without these experiences, my findings would lack any ethnographic richness.

The official functions I attended fell into two broad categories. First, there were the SANREM project functions. These included the NRMAC meetings, data collection trips by other SANREM researchers, a SANREM conflict resolution workshop in which I participated as translator for one day, presentations of findings by SANREM researchers to NRMAC members

and other local stakeholders. The NRMAC meetings were ostensibly held monthly, but in reality fell far short of that, particularly in 2004-2005, when they went 8 months without a single meeting. At these meetings, members discussed various topics, such as tree planting efforts, the development of management rules for a pasture rehabilitation sites, lessons from SANREM-sponsored travels to other parts of Mali, and the committee's financial status. Attending these meetings gave me a sense of how the committee functioned and how decisions were made.

Going out with other SANREM researchers on data collection trips enabled me to better understand the technological interventions undertaken by SANREM. It also gave me an opportunity to see first-hand how residents interacted with specific research projects and the project in general. The conflict-resolution workshops were often cited by NRMAC members as the most beneficial and significant part of the their experience in SANREM (see Chapter 8 for a more in-depth discussion of this). Participating in the conflict-resolution permitted me see how participants reacted to the workshop and each other in that context.

The second broad category of official functions in which I participated were those directly connected to the mayor's office and other governmental offices. The official functions that were most important to my research were the meetings called by the mayor in which the dates for descent of herds into and across Madiama were set. In both 2003 and 2004, I was able to attend the local meetings in Madiama. In 2004, I was also able to attend the corollary meetings at the circle and a regional levels in Djenné and Mopti respectively. These experiences gave me the opportunity to see how official decision-making processes are undertaken (officially) and how they relate to one-another up and down geographic scales.

In addition to the descent-of-the-herds meetings, I also attended meetings at the mayor's office regarding the assessment and prioritization of development needs in the commune, the

elaboration of a communal budget plan, recording-keeping of births, deaths and marriages, and locally initiated development efforts. Typically, these meetings involved one or more consultants and/or government officials from outside the commune who convened or supervised the meeting. While the topics of these meetings were sometimes marginally or even completely unrelated to my research questions, they helped underscore the challenges that government, especially the new local (communal) governments face in trying to facilitate development efforts in their communities. They also made me more aware of the local political landscape, which is more dynamic that appears at first glance, and how that can play into development efforts.

Finally, I attended several meetings convened by Les Amis de Madiama (The Friends of Madiama, henceforth referred to as LAM), an independent French NGO whose sole reason for being is to aid the development of the Commune of Madiama. The exclusive relationship between Madiama and LAM came about due to the fact that LAM was formed through personal channels. When communes were initially concieved as political units responsible for their own development, a man from Madiama who had long resided in France organized with some of his French friends and created the LAM. LAM has only existed since 2001, and is proving to be a windfall for the commune. LAM has financed public goods such as wells, the medical dispensary, school furniture, and even a vehicle for the communal government (used in official functions and medical emergencies to take sick people to the hospital in Jenné).

Being a participant observer in official functions is very different that being a participant observer in day to day life. Malians are accustomed to seeing whites attending and participating in official meetings at many levels. Seeing whites participating in the day to day activities of rural life, however, proved much more difficult for people to deal with. On several occasions, my attempts to participate in the work of daily life were thwarted by a combination of local

hospitality and social norms. Virtually every attempt I made to engage in anything even slightly resembling physical labor was met with emphatic efforts to dissuade me. Being a *tubabu* (white person), it was assumed that I didn't know how to do physical labor, much less have any capability at it. Even when the task at hand was entirely my own, such as patching the tire on my moped, I was often not permitted to do it myself. The few times when I got through the initial opposition, it wasn't long before my host put an end to it.

In an effort to make my research less burdensome for the people who took time to talk with me, I had initially thought to exchange time with people. If they talk to me for an afternoon, helping me do my work, I would give them an afternoon of my time doing their work. For example, early in my research, I once asked a good friend and informant, a very poor man with a small family, if I could help him weed his watermelon field. He had been generous with his time to me, so I thought I could do the same for him. He reluctantly humored my request to help, but within a few minutes he told me that I looked tired and that it was time for me to stop working. Actually, enjoying a little exertion for a change, I honestly replied that I was not tired and would like to continue. After more objections, he again reluctantly humored me and again, after a few minutes, tried to convince me to quit. This time however, he came and gently took the hoe from my hand, telling me that I must be tired and I should stop. Disappointed, and a little confused, I accepted his insistence that I cease to do useful work.

The larger meaning of this experience did not fully hit me until some months later, when, while conversing with another good friend in the center of town, we saw a young girl, around 15-16 years old go by crying woefully. My friend beckoned her over to discover the cause of her despair. It turns out that she was newly married and was living in her husband's compound, which included his parents. This is nothing out of the ordinary. But, on that day, her mother-in-

law had gone to the neighborhood well to draw water for her house's drinking water container, which had gone empty. That's it? That was it. Puzzled, I asked my friend to explain what the big deal was.

In patrilocal societies, newlywed girls are responsible for making the lives of their mothers-in-law easy, taking care of most household chores, including drawing water. By going to draw water herself, the mother-in-law was, whether intentionally or incidentally, making her new daughter-in-law look bad. The young girl was distressed that now her reputation would be destroyed, because it would appear that she was not properly fulfilling her social role, especially her obligations to her mother-in-law. Of course, the mother-in-law also should not have gone to get water when her daughter-in-law was there to do it for her, but may have done so absent-mindedly, out of habit, or out of desire to socialize around the well. Alternatively, it is also entirely possible that she did it intentionally to make her daughter-in-law look bad, in revenge for some other slight or shortcoming.

The lesson was that it is important for people to behave properly in accordance with their social position, be it high or low on the social hierarchy[1]. By not acting in accordance with their position, someone can bring shame not just upon themselves, but also on others around them. In my case, if my friend had permitted me to continue weeding his field, he would have brought shame upon himself by permitting me to work in his field and I would have brought him shame by insisting to do so. If a guest were to do work, even voluntarily, it would indicate poor hospitality. My experience as a participant observer was heavily influenced by the necessity of behaving in accordance with my position as a white American researcher. Sadly, the lazier I was,

[1] On an interesting and related note, at the conflict resolution workshop, participants were asked to list the ways in which differences between people were good. One of the responses was that it is beneficial that there are rich people and poor people, because it promotes social interdependence: rich people need poor people to hire to work for them, poor people need rich people to provide them with employment and income.

the happier people seemed to be with me. After all, powerful and important people like me should not do manual labor.

Full participation in any cultural milieu requires that one speak the language. One weakness of my research is that I was insufficiently multilingual to have good balance in my own experiences of the Marka and Fulani societies. My French and my Bambara were more than adequate for frank and undirected exchanges in either of those languages, and the two were frequently mixed, as is common throughout much of Mali. This skill enabled me to speak with virtually anyone on any topic in a Bambaraphone milieu. While I learned the fundamentals of Fulfulde, both through formal study in the US and through experiential field learning, I was never able to truly participate in the Fulani milieu in Fulfulde. By the time my fieldwork ended, I was able to exchange greetings and express very simple ideas in Fulfulde, but could not have spontaneous conversations. As such, my experiences of the Fulani milieu were largely through key informants who spoke either Bambara and/or French. While many Fulani speak at least a modicum of Bambara, they are generally disinclined to do so[2]. As one resident of the commune said to me

> Even if Fulani can understand [another language], they will never speak it because they prefer Fulani. Other ethnicities – Marka, Bozo, Bobo, Dogon – they are willing to speak other languages, but the Fulani are different in that they insist on always speaking Fulani.

I met a few non-Fulani who speak at least a basic functional Fulani, but it is very rare. Bambara is the language of the market and the dominant language of the country, so unless one grows up in close contact with a Fulani milieu, it is unlikely for a non-Fulani to speak Fulfulde well. Non-

[2] The number of Fulani in the Commune of Madiama who speak Bambara, and the degree of their competence is unclear. In my experiences attending mixed meetings, including SANREM functions, this issue of multilingualism is often brought to the fore through the question of whether or not the proceedings should be translated into Fulani. The Fulani would ask for translations, but many Bambara speakers loudly insist that all Fulani in the area understand Bambara just fine, a practice that looks a lot like browbeating. There appears to be a sense of competition for linguistic dominance, or at least accommodation of minority languages.

Fulani learning Fulfulde is undoubtedly even more rare due to the fact that Fulfulde is an extraordinarily complicated language.

Ethnoecological interviews.

In order to develop an ethnoecological interview protocol, I first wrote an outline of topics and specific questions. This was further refined and structured and then given to my field assistants, who were going to administer the interviews. My field assistance conducted trial interviews in my presence, which enabled me to refine the interview structure. As originally developed, the ethnoecological interview was several hours long, much too long to be successful in the local milieu. Informant burnout was a serious problem that needed to be anticipated in the development of the interview protocol. Informants were generally unwilling or unable to give their full attention to an interview that went over 2 hours, even when they were approached during a season with a relatively light workload. Signs of impatience could sometimes start to show as quickly as even one hour among some informants, so I needed to make sure that the ethnoecology interview protocol was succinct without sacrificing thoroughness. The test interviews were useful in that they led to clarification of numerous questions and the deletion of non-essential questions. While this represents a lost opportunity to gather some data that may have been interesting, it was a necessary trade-off to keep the interview manageable and to keep informants from revolting against the entire process.

The fact that the interview was to be administered in two different languages also posed a problem in its design. I decided to develop the interview protocol in French, so that my field and I assistants all had a single reference point for the interview. Not only was French the strongest shared language between the three of us, it is the language of science and research in Mali and it is the language in which we discussed the interview. Each of the two fields assistants were

responsible for translating the interviews into Bambara and Fulani as they were conducting the interviews, a process in which they both had a great deal of experience: both of them had conducted other surveys for SANREM researchers under the same circumstances. My research assistants recorded their notes from the interviews in notebooks that were later returned to me for transcription and translation. Notes from the Bambara language interviews were written in Bambara in order to retain greater data quality. Unfortunately, my Fulfulde is rudimentary at best, so notes from the Fulfulde language interviews were taken in a mix of French and Fulfulde. Key terms, such as soil names, were written in Fulfulde so that I could be taught key words and phrases by my field assistant.

I used stratified random sampling to create lists of 40 Marka households and 40 Fulani households for the ethnoecology survey. In the Commune of Madiama, there are far more Marka households than Fulani households. To complicate things, not all of the farmers are Marka: there are also two Bambara villages. The Fulani population of the commune live in three villages. Nerekoro is entirely Fulani, Nouna is entirely Fulani except for the family of the village chief and Promani is mixed Fulani and Marka. Consequently, I drew my sample from 5 villages. The Marka sample was drawn from Madiama, Tatia and Promani. The Fulani sample was drawn from Nerekoro, Nouna and Promani.

After ethnicity, I chose these specific villages because of their geographic proximity to one another. For each village in one sample, there is a village from the other sample that is nearby. This pairing was intended to reduce the possible effects of geography on soil typologies. The villages' proximity means that they share a similar local environment. Madiama and Nerekoro are only 3 km apart, Tatia and Nouna are even closer to each other and are officially

one village[3]. Finally, Promani which rests roughly between Madiama/Nerekoro and Tatia/Nouna is a former administrative center that is fairly evenly ethnically mixed, making it unique in the Commune of Madiama.

The sample for the ethnoecological interviews was drawn from communal tax roles, which the mayor of the Commune of Madiama generously shared with me for this purpose. Typically, a household will have one member who is in charge of overseeing and coordinating major production activities, such as planting, harvesting, herd management, etc.. In smaller households, it is often the head of the household, in larger household it might be a son or younger brother the head of household. When my field assistants went to conduct the interviews, they first went to the head of household, who would either participate in the interview himself or identify the relevant individual in his household to participate. I realize that this affects the representativeness of the sample, as households vary greatly in their size and composition. Unfortunately, there was no better sample frame to draw from, so I had to accept this limitation, which is common in West African research.

The sample was explicitly limited to men. I decided to do this for three reasons. First of all, in Mali's very patriarchal societies, control and management of natural resources and household resources rests squarely in men's hands, making them the relevant user group from which to draw a sample. Secondly, in the intensely segregated cultural context of Mali, women's knowledge and management of land should be treated as a subject that merits its own independent analysis. Third – a reason more practical than methodological – access to women for interviewing poses a whole different set of challenges and obstacles that would have impeded the progress of the research.

[3] This unity is a legal fiction, but neither village is large enough to constitute an official village for the national government's purposes.

In order to determine my sample, I counted the entire number of Fulani and Marka households in the sample villages and divided them by 40. Due to the fact that there is a much smaller Fulani population in the commune that Marka, this sampling technique rendered samples of approximately 17% of Marka households and approximately 50% of Fulani households in the villages in the sample pool. In the ethnically mixed village of Promani, I separated out the sample pool by identifying Fulani by their last names, which are clearly distinct from the last names found among the Marka there. This technique was supported by my field assistants as a sound method of dealing with the issue.

When interviewees were reached, my field assistants explained the nature and purpose of the interview and explained that participation was voluntary and anonymous. Respondants were never paid. Upon starting the interview, responses were recorded in notebooks. While my field assistants had the list of heads of household drawn for the sample, the informants' names were not entered into the interviewers' notebooks. Unfortunately, participation in the ethnoecology interviews was not even between the Marka and Fulani samples. After refusals and absences, there were 38 interviews with Markas and 26 interviews with Fulani.

The low degree of participation among the Fulani did not surprise my field assistants, as it reflects two aspects of their lifestyle and worldview. First, while someone might be listed as being from a village, that does not necessarily mean they are ever there. Many of the Fulani in the sample were away on transhumance with their herds and their entire families, and were nowhere near the Commune of Madiama. Second, according to my key Fulani informants, there is a general reticence among many Fulani, particularly acute among those who spend a lot of time on transhumance, to have any contact with government agents, researchers or any unknown

people, including my field assistant and 4-year SANREM research technician, Albadia. As one key informant put it,

> Even this morning, Albadia went to a Fulani man on the other side of the highway to do an interview for you. The man hid in his hut and told his daughter to tell Albadia that he was out. He didn't know Albadia and didn't know why he was coming there. But he approached on a moped, wearing his city clothes, and the guy hid himself. I happened to talk to him later and he asked me who the guy on the purple moped was. I told him that it was OK, that he just wanted to talk, but he isn't interested. Albadia will not get your interview with this man.

The fact that the man did not already know the man on the purple moped was indicative of his disconnectedness from Madiama. Albadia had lived in Madiama for four years, had conducted research throughout the commune and spoke Fulani. Furthermore, his was the only purple moped that I, or anyone I knew, had ever seen in all of Mali. Any Fulani who had been in the commune much, would have easily recognized Albadia, by his face and his moped if not by name. Although the prospective interviewee officially "lived" in the Commune of Madiama, his transhumant lifestyle only found him in the area in passing.

Politics and Identity

It is axiomatic, if not a cliché, to say that there is politics in everything, and natural resource management in the Sahel is certainly no exception. In the Niger River Inland Delta region, the management of soils and pastures is intimately tied to access to power and material resources, which are both linked to questions of sociopolitical history and ethnic identity. These aspects of knowledge are usually excluded from local knowledge studies, which typically focus on "technical" knowledge.

In keeping with SANREM's use of an integrative "lifescape" approach, I decided to research how local knowledge is related to the broader lifescape of the people who hold it. Technical knowledge is certainly an important aspect in NRM decision-making at the producer level, but in order to put the "system" solidly into a "local knowledge system", there are other things that need to be considered: knowledge of (and behavior within) sociopolitical history and

contemporary political functioning, concepts of ethnic identity, and the social meanings attached to production activities. I collected data that addressed the aforementioned themes in an effort to set my ethnoecological findings in a meaningful social context, and really to expand the very notion of local knowledge itself. In addition to talking with rural producers, I conducted semi-structured interviews with key decision-makers about the politics of land management and herder-farmer relations, with a particular focus on management of the descent of animals through the Commune of Madiama and into the floodplains of the southern part of the Inland Niger Delta. Interviewees included government officials at the communal and circle level, Malian development professionals, and key local actors.

In addition to the semi-structured interviews with key actors, I also informally explored these themes with folk throughout the course of my fieldwork. I discussed these themes with both Marka and Fulani, key informants and random acquaintences. The conversations moved around the questions following questions: How do people characterize their own ethnicities and others? How does ethnic identity contribute to people's productive behaviors and decision-making? What are their strategies for negotiating land management goals? How do people understand and interact with government at various levels? How have these interactions changed with changing governmental regimes?

CHAPTER 5

RESOURCE TENURE, SOCIAL STRUCTURE AND HISTORY

Land tenure, being the social construction of rights of access to resources, is a central aspect of people's relationship with their environment. Land tenure systems are the result of both cultural values toward land as well as political maneuvering for control over it. This makes land tenure an important social context in which to situate local ecological knowledge and resource management practices. Critics have long said that African land tenure practices promote environmental degradation (for a critical review of African land tenure systems see Platteau 1996). The argument goes that lack of formal ownership promotes land degradation because it discourages investment in land maintenance and improvement. I have found both supporting and contradicting evidence for this phenomenon in the Commune of Madiama.

Social structures and land tenure[1]

Land tenure is a complex aspect of production in Mali and is, like most things, tied to social structure and history. Traditionally, there are two official positions relevant to land tenure, the *dugutigi* and the *dugukolotigi*, the "owner/chief of the village" and the "owner/chief of the land" respectively.[2] The institution of the *dugukolotigi* is locally reckoned to be as ancient a form of land tenure as is found in central Mali. It simply indicates that someone, some family,

[1] All foreign language words in this section are Bambara unless otherwise indicated. I discuss land tenure from farmers' perscpective because they have inhabitted the area longer and so have defined its structure more than herders, who have by and large adopted, or been integrated into, farmers' model of land tenure. The outstanding exception to this is the case of the *jowros* in the inner delta, as discussed in Chapter 3. The overall household structure described here also applies to the Fulani.

[2] The Bambara word *tigi* has numerous uses with subtle differences, sometimes making its translation a little slippery. When used following nouns, it can mean "owner of" or "chief of" or "person responsible for". In Mali, when translating these words to French, the custom is to use "*chef du village*" and "*chef du terrain*", the "chief of the village" and "chief of the land" respectively.

has laid claim to a territory for a long time (usually immemorial) and has successfully maintained that claim. It is a position that exists in relation to environmental exploitation, and not social life. For example, anyone who would want to found a new village somewhere would seek the approval of the *dugukolotigi*, who would grant them a defined area for the village and the village's fields.

Subsequently, a family that founds a village becomes the *dugutigi* of that village, a position that, like *dugukolotigi*, flows down the patrilineage of that founding family. Any member of the family that holds the chiefdom of a village can be called *dugutigi*. It is a title that refers both to the individual of the village chief and to the entire family that holds the chiefdom. The individual who is the designated village chief is typically the oldest living male member of that lineage, regardless of his age or even competence as a decision-maker. Any problems of competence are to some degree balanced out by the politically active members of the village chief lineage who act as advisers to the chief himself. These advisers are often brothers or sons who act as agents for the individual village chief. Consequently, the chieftancy really rests with the entire familiy.

Within the boundaries of a village's territory, fields are distributed by the chief to heads of households, who in turn distribute fields within their housholds. There is no formal, titled ownership of land, though my interviews strongly suggest that it is very rare for households to entirely lose fields once they are acquired. Most informants said that the fields they worked had been in their family for generations, indicating a form of *de facto* ownership. The use and management rights for a field apply only to annual crops and do not extend to trees found within that field, unless they are planted and nurtured by the farmer. While a farmer might own a field, any wild tree products found in that field, such as shea nuts, balanzan fruits, or even whole limbs

that can be cut for forage, are common property and can be harvested by anyone (the issue of trees and tenure will be further elaborated later in this chapter).

Economic production is organized into the *du*, which best translates as household. Household is both an anthropological and legal term, the two being loosely correlated in actual practice. The legal aspects of households are discussed briefly in Chapter 3. Suffice to say here that the head of household is the one responsible for paying taxes to the government for all the people contained in his household. Anthropologically speaking, I have found that Netting's theorization of the household is particularly applicable in the Malian context.

> The household is the scene of economic allocation, arranging collectively for the food, clothing and shelter of its members, and seeking to provide for these needs over the long term with some measure of security against the uncontrollable disruptions of the climate, the market economy and the state. The corporate continuity of the household unit is apparent not only in the reproduction of family members and the interdependency between generations but also in ongoing property rights in the means of production. Valuable and scarce land . . . may absorb the energies of the household, provide its livelihood, and condition its future. When subsistence, investment, and wealth are embodied in the fields, livestock, trees, implements and buildings, a center of economic gravity is formed that attracts and influences the movements of the household members who hold and inherit these assets (Netting 1993:59-60).

While Netting goes on to stress the importance of "co-residency" for a household, my experience did not show this to be a necessary element of a household. It is not unusual for brothers in the same economic household, whose families eat from the same pot, to have separate compounds. One possible reason for this difference is that Netting was explicitly focused on households in communities that practiced *intensive* agriculture, whereas Madiamans practice a much more extensive form of agriculture. Also, the economic geography of Netting's predominant field sites in Nigeria and Switzerland is such that household compounds are usually located on the sites of production, the fields. In Mali, household compounds are all clustered in the villages and the fields are found surrounding the villages. Differences in residency patterns are minor in understanding households as economic units. As long as the idea and practice of economic unity exists, geographic unity of households is not necessary. In Mali, the size and

structure of a household can vary greatly, from a single nuclear family to a vast extended family network. Fully exploring the range of variation and the social processes, strategies and rationales for decision-making that shape household coherence and fission would require its own dissertation. However, a few generalizations can be made. Some households consist of a nuclear family, some combine extended family networks united under a single patriarch. It is common for two brothers, with all of their wives and children, to combine into a single household, sharing productive activities and combining the profits thereof.

The head of household manages financial and labor resources, often literally holding the keys to the granary, making him the gatekeeper of economic production and consumption. Traditionally, all profits belong to and are managed by the head of household. If a young man who is not the head of household ventures to make some money, he is obliged to give it to the head of his household, be it his older brother or uncle or father. It is then up to the head of household to redistribute the money as he sees fit. The remittance of all personal profits to the head of household is reportedly starting to change, with an increasing sense of individual ownership over profits of certain economic activities, but it is far from being the norm, at least in Madiama. Women's profits provide an exception to this rule. Women don't often participate in the cash economy to the same degree as men. When it occurs, women's profits are generally meager and remain in women's control.

When a villager wants to clear a new field, he goes to his village chief to ask permission, The village chief should then, in principle, take the matter to the chief of the land. Sometimes, the family that holds the chiefdom of the oldest village in an area is the same as the family that holds the chiefdom of the land, though not necessarily. Although the positions of village chief and chief of the land are held by patrilineages, they can change lineages under some

circumstances. The village chief is responsible for managing village social life, resolving conflicts with other villages and within his own village. Within the village, his word is final. In terms of land, the village chief is in charge of permitting members of his village, or even people from other villages, to clear new fields within his territory. As a village's population grows and the infrastructure needs expansion, it is the village chief who authorizes and taxes all construction of houses, as well as commercial buildings.

Part of building a new home is the acquisition of land and it is the village chief who is in charge of granting land for home building. This includes the power to take an agricultural field away from one person in order to grant it to another person as a site for home construction. All of my informants agreed however that the village chief *does not* have the authority to take an agricultural field away from one person to give it to another for the purposes of agricultural production. Someone who is entirely new to town must first go to the village chief to seek a field, but they may be refused, as happened with the SANREM research technicians who were based in Madiama for 4 years. In this case, it is up to the newcomer to find a field through their own social networks, forcing newcomers to quickly integrate into the local social network. Village chiefs have the authority to convert land use, from bush to field and from field to residence, but does not have the authority to convert ownership of a field or home from one person to another for the purposes of continuing its current mode of use. Although there is no title to land, when someone wants to acquire land upon which to build, he must go to the village chief to seek the land. If the village chief agrees, the person seeking the land pays a fee to the chief. It is not clear whether this money is buying the land, or is an obligatory show of

appreciation for the chief having taken the time to consider and approve the proposal[3]. Either way, there is an obligatory financial exchange connected with the acquisition of land.

Legally speaking, clearing new fields must be approved by an agent of the national government agency *Eaux et Forêt* (Water and Forest), which is the department that oversees exploitation of rural resources. In reality, national government agencies are notoriously weak and application of rules that require intervention of national agents is erratic. One *Eaux et Forêt* agent explained to me that even after several years on the job, his own supervisor could not even supply him with a copy of the laws and regulations he was responsible for enforcing. Instead, he managed to acquire a photocopy, at his own expense, through a friend of a friend.

During colonial rule, it is generally reckoned that the French did not attempt to interfere with traditional land tenure arrangements (other than to establish that the colonial government had the right of eminent domain). While the post-independence government of Moussa Traoré reinforced this, saying that all land belonged to the state, "customary" land tenure systems are legally recognized and officially carry the force of law. Decentralization is in the process of undoing some of the concentration of power over land management. "Lands without master" are are no longer the property of the central government, but are to be managed at the communal level. National policies, such as the rules of the *Eaux et Forêt*, still apply, but the development and enforcement of management plans falls increasingly on local governments and villages.

[3] This practice is consistent with other gifting practices in West Africa. For example, anyone who goes to visit the chief on any official business must buy a few kola nuts to give as a gift just to get an audience, though cash is also accepted. Gifting with kola nuts is a very old way of showing respect and kola nuts have great symbolic potency throughout West Africa.

Trees and tenure

With the exception of trees that are intentionally planted and cultivated[4], trees are common property, meaning anyone can harvest fruit or cut wood from any tree, anywhere. They can be cut by anyone for any purpose. Wood cutting is done to make charcoal, to harvest cooking fuel, to construct houses or fences or to give fodder to animals. An agent of *Eaux et Forêt* pointed out to me that it is officially illegal to cut tree branches for the purpose of giving the fodder to livestock (Government of Mali 1999). It is, however, a ubiquitous practice and the law banning it is never enforced. Upon hearing of this law, a SANREM colleague laughed and called the law completely incompatible with intensive pastoralism, which requires cattle owners to bring food to their animals. Intensification of pastoralism is an express goal of the Malian Charte Pastorale, a new legal code governing pastoral resources. However, the name of the Charte Pastorale is little known by rural people and the content even less so.

The majority of the trees found in the fields of central Mali are either shea trees (*Butyrospermum paradoxum*) or balanzan trees (*Faidherbia albida*). Shea trees are the source of the nut from which shea butter is derived. Shea butter is the indigenous cooking oil and doubles as a skin care product. Shea trees are economically valuable enough that people avoid cutting them because they are more valuable alive. Although farmers permit shea trees to grow in their fields, the nuts they produce do not belong to that farmer. Instead, they belong to anyone who comes to harvest them, meaning there is not necessarily any direct benefit to the farmer himself.

Balanzans have three qualities that make them ideal as field trees. First, balanzans are leguminous, meaning they fix atmospheric nitrogen in the soil. A large balanzan contributes significantly to soil fertility and so has a clear and direct benefit to farmers. Having visibly seen

[4] Around Madiama, the most commonly cultivated trees are mango and papaya. These are usually found in women's designated garden areas.

the effect of balanzans on soil fertility, rural producers often express this aspect of balanzans in terms of their leaves being rich fertizer for soils. This is based on the notion that the leaves fall from the tree to add richness to the soil, as the fixing of atmostpheric nitrogen is not a perceptible process using folk science methods. Second, balanzans' leaves grow in the dry season, rather than during the wet, agricultural season. Consequently, having a large balanzan in your field does not mean having a large shady spot, a significant consideration for farmers in a land-short environment. Finally, balanzans' leaves and fruitsare highly valued as fodder. The leaves are useful only for goats because the limbs are covered with tiny thorns that only the nimble lips of goats are able to avoid while nibbling off the leaves. Using balanzan leaves as fodder requires the cutting of branches of balanzan trees. In addition to its leaves, balanzan fruits also make highly nutritious livestock fodder, but heavily cut trees do not produce fruits. It is officially illegal to cut balanzans for the above reasons, though the practice is widespread due to lack of enforcement.

Unlike wild trees, which grow of their own good fortune, trees that are planted and maintained by someone belong to the planter. In the commune of Madiama, there are three kinds of trees that are commonly planted. First, fruit trees, usually either mangoes or papayas, are planted in designated, and usually enclosed, garden areas. The climate in Madiama is too dry for fruit trees to grow without watering, making fruit production labor intensive and limited in scale. Second, drought-resistant neem trees (*Azadirachta indica*) were introduced and promoted during the anti-desertification campaigns of the 1980's and 90's. Neem trees are commonly found as shade trees in household courtyards as well as in public places. While neem trees that were planted in courtyards are sometimes cut for construction wood, public trees are not allowed to be

cut as they were planted by the public for the public. Only the village chiefs have authority to cut public trees.

Finally, local voluntary associations have recently taken to planting trees in private plots outside of the villages. The associations usually plant either fruit trees, neem trees or eucalyptus trees (*Eucalyptus* sp.) typically in non-cultivated open areas a little outside of town that belong to an association member. The motivation behind this tree planting is complex. While knowledge of the values of trees for conserving water in the soil and in inducing rain has been spread by INGOs in the area, associations do not appear to be planting trees for these reasons. The contemporary international development climate is one in which individuals are no longer awarded development resources, but collective associations may be. Enough rural people are keenly aware of this policy shift that associations are springing up very rapidly in an effort to make themselves available to development resources. The NRMAC associated with SANREM has planted several plots of trees, as have other village associations in the Commune of Madiama. Many associations have formed in the last few years which have planted trees as a means of establishing themselves. While people recognize that the economic benefits of tree-planting do not materialize quickly, if ever, it is seen as an effective and relatively inexpensive way of illustrating that an association is active and legitimate. While the INGO's have said that trees can help induce rainfall, peasant associations appear to be betting that tree-planting may also help induce windfalls of money from INGOs.

Pasture Tenure Systems

Thus far, all discussion of land tenure has focused entirely on fields, the domain of agriculturalists. Rights of access to pasture land is not a significant issue in the Commune of Madiama, as there are few proper pastures there. The foundation for the contemporary system of

land tenure for pastoralists was established nearly 200 years ago when, from 1818-1878, the entire NRID was ruled by the theocratic Muslim Fulani kingdom known as the Dina (Fulani,. from Arabic, “the religion”. See Chapter 3 for more detail on the rise and fall of the Dina). Being relatively recent immigrants who were entirely transhumant, meaning they had few, if any, established villages, the Fulani did not control much land according to the customs of land tenure described above. The rise of the Dina changed all that, especially in the floodplains.

The rich and highly valued bourgou (*Echinoloa stagnina*) grass grows throughout the inundated zones of the Delta. Bourgou is a species that thrives in standing water, is very nutritious for cattle, and so is prized by herders. Aside from the water itself, bourgou is the reason that pastoralism in Sahelian West Africa hinges so strongly on the NRID. Because the interior floodplains of the NRID are the central nodes of pastoralism in the entire region, I will start my discussion of pasture tenure systems with the floodplains and then move to a discussion of the highland, wet-season pasture.

The Dina is credited with establishing a well-thought-out and strictly-enforced system for managing the transhumance, the entry and exit of the herds into and out of the floodplains (Cissé 1985). The first step in this rationalization of resource exploitation was dividing the Delta into administrative units, called *leydi* (Fulani, lit. “lands”), that fell under the management of individual administrators, called *jowro,* an institution that exists to this day. *Jowros* act independently of village chiefs, though there is traditionally some tribute paid to them. *Jowros* are responsible for managing their *leydi* and coordinating all user groups: farmers, fishers, and herders. As *jowros* have always been Fulani, it is easy to see that grazing would have been the favored activity. Still, *jowros* retain the right to partition access, geographically and temporally, among the user groups as they see fit. A part of this is the right to ask whatever fee they see fit

for that access. Since its inception in the early 19th century, the position of *jowro* has been inherited patrilineally. This fact, combined with the high value of access to floodplain lands, has led to the effective privatization of the *jowro*'s *leydi*. It has also gradually made the *jowro* families extremely rich and powerful. In olden days, the *jowros* who managed the descent of herds into the floodplains from the highland pastures, informed herders when the pasture was ready for the herds to enter. The custom was for the *jowro's* own herd to enter first, followed by the herds of his village and they others.

In addition to dividing up the vast bourgou pastures among the *jowros*, Sekou Amadou established designated trails along which the Fulani herds could enter and exit the floodplains. The idea behind these trails was that herds should be able to pass in and out of the delta without trampling farmers' fields or disturbing Bozo fishing grounds. The trails were designed as a mechanism by which conflict could be avoided through the definition of access rights and the minimization of contact between user groups. A system of temporary lodgings for passing herders was also organized so that transhuming herders would not have to sleep exposed to the elements while transitioning from highland to floodplain pastures along these predictable routes.

The cattle trails established during the Dina exist today and are still used, including one passing through the middle of Madiama. Through all of the regime changes that Macina has seen over the last 200 years, the cattle trails have continued to be recognized through annual use. However, they have also seen a diminution of size through increased encroachment of fields into the paths, which recieve large amounts of animal manure during the passage and so appeal to farmers. Access and management issues surrounding this trail is today a contentious topic, in Madiama as elsewhere.

The issue of tenure in upland pastures is very different than in the bourgoutieres of the floodplain. Given that population densities were historically very low in the Sahel, pastoralism, like farming, used to be very extensive. Small farming villages surrounded by their fields dotted the uplands, but did not dominate the landscape as they do today. Consequently, upland pastures were never explicitly defined like lowland pasture were. Instead, herding took place in all of the spaces that were not farmed and most of the landscape was constituted by pastures. Upland pastures are still effectively just the negative space of farming, but more and more space is being transformed into fields. The result is that pastoralism is being pushed into increasingly marginal lands and compressed into smaller spaces. The maintenance of upland pastures is done at the discretion of the areas' village chiefs and the chiefs of the land, who are rarely Fulani. The areas upland from the Commune of Madiama are populated mostly by Bobo, Dogon, Dafin, Mossi and Bambara. Bobo and Dogon are the longest inhabitants in the area and so have more power over land use. All of these groups are primarily farmers and tend to act in the interest of agriculture over over pastoralism. This could also be characterized as them acting in the interests of local resource users over non-local resource users.

Case studies in land tenure dynamics in Madiama

Located at the very edge of the floodplain, the Commune of Madiama does not have any bourgou pastures of consequence and there are no *jowros* in the commune. I was told that one has to go to the far side of Djenné to find the nearest bourgou pastures. In the case of the Commune of Madiama, the institution of *dugukolotigi* is hardly recognized any longer. There are several factors that have contributed to this situation. Historically, the *dugukolotigi* of the entire area that has become the Commune of Madiama was the village chief of Nouna. Today, Nouna is the smallest village in the commune. Regardess of its small size, Nouna is widely acknowledged

to be the oldest village in the area, founded by Bozo fishermen drawn to its position at the edge of the vast floodplain, though prior to contemporary reduction in rainfall it used to be more *inside* the floodplain.

Although Nouna was originally a Bozo village, though today the village chief's family are the only Bozos left there. Bozos, being fishermen, obviously gravitate toward water. The village chief of Nouna told me that the earliest settlers determined that Nouna's territorial domain was all the *jimayooro*, the "places with water". When the average annual rainfall was 150% - 200% of what it is today, the floodplain included all but the furthest eastern reaches of the commune, where flood waters never reached. Nouna is situated in the crotch of a bend in the river, though the main channel of the river is 10 km away to the north and 13 km away to the west. Today, all of the area directly between Nouna and the river is still floodplain, at least in the years of ample rainfall, and all of it belongs to Nouna.

The chief of Nouna used to control the entire floodplain east and south of the main channel of the river. He would dole out rice fields to interested farmers in exchange for a semi-voluntary sack of rice after the harvest. Today, the better part of that floodplain has been taken by the state to develop into a *casier* (Fr., lit. "filing cabinet", also used as "pigeon hole", so named because the area is divided up into a neat grid of 1 ha squares when allotted to farmers). The *casier* is a government managed, flood-controlled rice production zone[5]. Although the chief of Nouna has lost control and management of this part of the floodplain, Nouna has retained control of a large swath of floodplain rice fields in the *hors-casier* (Fr., lit. "outside the filing cabinet"), an area of the floodplain north of the dike that is not flood controlled.

[5] Incidentally, it is against the rules to plant traditional varieties of rice in the *casier*; they accept improved varieties only. The rationale is that if the government is going to invest in the development of this area, through construction of dikes and water control gates, they insist that the farmers grow only the most productive varieties in the interests of national food security.

Despite his recognized position, the chief of Nouna is rarely consulted or effective in his role as *dugukolotigi*. The family that holds the chiefdom of Nouna is Bozo, one of the last remaining Bozo families in the entire commune. The village of Nouna is otherwise entirely Fulani. According to the current chief of Nouna, the transition from Bozo village to Fulani village occurred a long, long time ago. Although he has customary rights on his side, the chief of Nouna does not have many people in place to back up assertions of power in the commune. In addition, most of the arable land in the commune has already been converted into fields, so the allotment of new fields for clearing is not a major question anymore.

Farming is not limited to the territories of one's own village. As villages have grown, some have outgrown their own territories and their inhabitants have resorted to seeking fields in neighboring, and sometimes even distant, villages. The residents of burgeoning villages that are completely circumscribed by other villages, such as Madiama, must appeal to the village chiefs of other villages that have agricultural space to spare.

History and power in access to land: Beer for fields?

The territory that actually belongs to the village of Madiama is proportionally small in comparison to its population. However, Madiama's neighbor to the east, Kessedougou, controls a relatively large expanse of land, despite the fact that its population is roughly 15% of that of Madiama. Kessedougou controls much more land than its approximately 300 inhabitants need. Although Kessedougou lies on the highway 5 km from the village of Madiama, the border of its territory reaches to within ½ km of Madiama, meaning that the land immediately to the southeast of Madiama does not belong to the village of Madiama. Even though the land is in the legally-defined boundaries Commune of Madiama, which stretch all the way to the highway where Kessedougou is located, the land belongs to Kessedougou. This illustrates how the new political

organization which created the commune has been superimposed upon existing organization rather than replacing it.

The incongruity between village size and territory seems odd at first glance, but it is a function of history and land tenure traditions. Kessedougou, while it is not as old as Nouna, is still much older than any of its immediate neighbors. In fact, Kessedougou used to be much closer to Madiama, but was razed in a war during “the time of Sekou Amadou” (the Dina) and rebuilt at its new location a few kilometers to the east. Despite its physical destruction, the remaining families of the village relocated slightly and rebuilt. Consequently, the Kessdougou retained ownership over its previous land holdings.

Despite the fact that the land belongs to Kessedougou, nearly all of the fields between Madiama and Kessedougou are farmed by Madiamans. Even many fields on the far side of Kessdougou are farmed by Madiamans. In order to gain access to the lands of Kessedougou, Madiamans must go to the chief of Kessedougou and ask permission. In return for granting permission, the farmer is expected to give a bundle of millet to the chief after harvest. This custom is not strictly enforced, but everyone knows that if you want to stay in the good graces of your landlord, it is best to show proper respect.

Once granted, fields stay within a lineage except in the case of transformation to household sites. This only applies, however, to land that is received from one’s own village. Accessions from other villages are understood to be loans and are retractable by their owners, by custom and more recently by law. This is an important aspect of the recent history and politics of the fields in Kessedougou. Much of the spare land belonging to Kessedougou was until recently farmed by residents of Ouan, another Bobo village 8 km down the highway. This changed

abruptly when the farmers from Ouan were kicked out by the chief of Kessedougou as a result of a political disagreement between villages.

> If there was a need, I could force the people of Madiama to leave the fields so that Kessedougou could farm it. It used to be that people from Ouan came here to farm in our land, but they don't anymore because of an argument about joining their commune. Ouan wanted us to be a part of their commune, but we joined Timissa. People in Ouan didn't like that and so we started fighting. Now people from Madiama are moving in and farming the fields where people from Ouan used to farm. For over 20 years now, many people from Madiama have gotten fields in Kessedougou. All of the fields up to the path between Madiama and Doucarani belong to Kessedougou. Kessedougou hasn't needed all that land because there aren't many people here, but I can make the Madiamans leave when I want to. I can do it without any problems because the law agrees with me.

From an agroecological point of view, one could say that Kessedougou should use their abundance of land to practice fallowing and maintaining soil health. However, that would not be socially acceptable behavior for the chief when it would leave his neighbors with an acute land shortage. However, in addition to providing the village chief with many bundles of millet given annually by renting farmers, lending out land also gives the chief of Kessedougou significant political leverage in Madiama. The Madiamans who farm in Kessdougou's territory are aware that they are able to do so only because the chief of Kessedougou recently evicted the previous tenants. While the arrangement has tightened relations between the villages of Madiama and Kessedougou, the relationship is not one of equal power.

Kessedougou is a Bobo village and Madiama is Marka. Throughout Mali, Bobos are known as one of the ethnicities that have most tenaciously resisted conversion to Islam and have openly maintained their animist religious practices[6]. One aspect of being unconverted is that Bobos are also known as avid beer brewers and drinkers, practices that are not well looked upon

[6] Exactly what these consist of remains a mystery to me, though I was frequently warned against visiting Bobo villages because a) they might feed me pork or dog or horse meat, a revolting thought to good Muslims and b) they are said to practice human sacrifice and generally prefer strangers to locals. Bobos themselves do not deny that this used to be the case, though they say that it has been a long time since human sacrifice has actually been practiced. Still, in the season just prior to planting, there is a month during which all surrounding villagers are warned to stay out of Kessedougou because they are engaging in secret rituals to promote a good agricultural season. Anyone entering the village, especially at night, is said to be risking their own lives by doing so. All indications are that this warning is thoroughly heeded.

by the conservative Muslim establishment in Madiama. All the same, the weekly market in Madiama draws many Bobos from the highlands to the south and east of Madiama and there is a lot of beer that flows past the lips of Bobo[7] marketgoers. The *dugutigi* family in Madiama, which organizes the social aspects of the village including the market, has progressively marginalized the Bobos through the repeated relocation of the designated beer-drinking site to locations more and more remote from the main market.

In 2001, during my first research trip, the beer vendors were located in a central plaza next to the grammar school (not in session on market days) and contiguous with the rest of the market. In 2003, the beer drinking site had been relocated to the edge of town, a short walk from the market. By 2004, it had been pushed even further out to a large tree in a field beyond the edge of town, in an area that is undergoing a lot of new home building and will soon be circumscribed by household courtyards. This was apparently still too close for the village chief of Madiama and there was talk about moving the drinking area yet further away from town. This move was seen as denying the beer vendors a permanent location at the market and further marginalizing the Bobo contingent of the Madiama market, which brings me back the chief of Kessedougou.

As a respected leader in the broader Bobo community with political leverage in Madiama, the chief of Kessedougou put his foot down, saying that if the chief of Madiama did not establish a permanent location for the beer vendors and consumers, he would retract all of his territory from Madiaman farmers. Reactions in Madiama clearly indicated that they did not take this as an idle threat. A large meeting was held in Kessedougou bringing in a large delegation of civic leaders from Madiama, as well as numerous regular folks who farm in Kessedougou's

[7] The beer drinkers in the Madiama market come from numerous ethnicities, but the overwhelming majority are Bobos and the vendors are all Bobo. In Madiama, the beer drinking area is also known as the "Bobo area" a mode of reference that I have adopted here.

territory. As much as I wanted to attend this meeting, I was excluded. “This is not a matter for strangers” I was told curtly by a prominent counselor to the chief of Madiama, who was clearly perturbed that I had even gotten wind of the matter.

The following week, a small group of Madiama’s civic leaders, all members of the village chief’s family, could be seen pacing around the general area where the beer vendors had recently been located, gesticulating energetically and arguing in tones that could be heard from a distance. Trying to resolve the matter was visibly stressful for them, but the threat of losing access to Kessedougou’s land was alarming enough to convince them to address the issue of establishing a permanent location for beer vendors and drinkers near the central market. This episode illustrates that Kessedougou’s ownership of the land was clearly recognized, despite the fact that the people of Kessedougou have not farmed it in living memory. Ownership over this swath of land gives Kessedougou’s chief a great deal of power in Madiama. At the time of my departure in March 2005, a final agreement had not been established between Madiama and Kessedougou, though the chief of Kessedougou was confident that he would get what he wanted and likewise, the advisors to the village chief of Madiama were confident that something would be worked out. The leaders in Madiama did not consider losing those fields as an option.

Social history and resource tenure

In the case of Kessedougou, even when it was destroyed by war and rebuilt in another location, it retained control over its original territory. The cases of villages that were destroyed and never rebuilt are even more telling of the stability of land tenure. The Bambara village of Tisombougou used to stand on a rise of land at what is now the southeastern edge of Madiama, on site of the newly built middle school. It was also destroyed in “the time of Sekou Amadou”, around the same time that the original Kessedougou was destroyed.

Unlike with Kessedougou, the surviving inhabitants of Tisombougou scattered and the village was never rebuilt. Some survivors left the area entirely, while a few relocated to Madiama. The fields of those who left reverted to ownership of Kessedougou, the village that initially granted them. However, those who simply moved over to Madiama kept their holdings even though the village that granted them no longer existed. The land is recognized as belonging to them. The village chief of Madiama has never officially had the authority to take back the fields, as it was not the chief of Madiama who granted them. However, inasmuch as the families that relocated from Tisombougou participate in the social life of Madiama, their properties are still subject to takings for residential use, or for public use, such as a school.

History vs. geography in resource tenure

Another example of land tenure meshing with history is the case of Tiyɛn, in southwestern corner of the commune of Madiama. In a Sahelian environment, any place that gathers water and retains it is a valuable resource. Despite the fact that there is such a pond located right next to the village of Sarantomo, the people of Sarantomo do not have the rights to fish in or farm around this pond, because it belongs to the village of Tiyɛn, a village in the Commune of Madiama 6 km to the other side of Sarantomo. The people of Tiyɛn exploit the pond, which is fed by rainwater runoff as well by river flooding (in the years of heavy flooding) for fishing and flood recession agriculture agriculture.

A strictly geographic notion of resource rights would suppose that the pond should be a resource that belongs to Sarantomo. But again, history trumps geography in the construction of resource rights. Tiyɛn is much older than Sarantomo, and has been exploiting this pond since before the village of Sarantomo was established. Long ago, when the founding families gained the rights to establish Sarantomo, the village chiefs agreed that the pond would continue to

belong to Tiyɛn and that Tiyɛn would maintain exclusive exploitation rights. Despite the fact that neither the pond, nor even Sarantomo are located in the Commune of Madiama, the pond continues to be a part of the resource base for inhabitants of the people of the Commune.

Balanzan management

In terms of resource management, one of the notable successes of the NRMAC and the mayor has been the banning of cutting balanzan limbs. Cutting tree limbs for use as animal fodder is officially illegal throughout Mali, but is unenforced, as it is a requisite of intensive pastoralism, which the government wants to encourage. However, recognizing the value of balanzans as maintainers of soil fertility and the value of their fruits as animal fodder, one of the first actions of the NRMAC and the mayor in 2000 was to combine forces and enforce the cutting ban specifically on balanzans. Cutting is punished with a fine of up to 5000 CFA, depending on the extent of the cutting. The proceeds of this fine go to the mayor's office.

Prior to the ban, balanzan limbs are reported to have been cut frequently and heavily in order to augment the diet of goats, which are preferred investments for farmers with extra cash. This practice was leading to a decline in balanzans, in terms of their health and ultimately their numbers. Unfortunately, I cannot make personal observations on the changes, as I never saw the state of Madiama's balanzans prior to the ban, though all observers say that the difference is marked. I did have occasion to visit Konio, the commune south of Madiama, where there is no effective ban on balanzan cutting. Their balanzans looked very tired and haggard. Many balanzan trees were just large trunks with a few twiggy branches jutting out here and there. The balanzans in Madiama which, by the time I left, had not been cut in five years, made for a significantly different visual landscape. They were much fuller and green. I was told the trees in Konio are what the trees in Commune of Madiama used to look like.

One of the benefits of not cutting balanzans is that when their branches are permitted to grow, they produce a large volume of fruit. This fruit is highly valued as animals fodder. Residents of Madiama claim that they have seen the benefits of not cutting balanzans through the quantity of balanzan fruit that they are now able to harvest for their goats and sheep. By enforcing the cutting ban, the mayor's office has taken over one aspect of the management of balanzans, but not all. Balanzan trees are still a common property resource and their ubiquity in the fields means that the fruit is not overly scarce. The season for balanzan fruits is a busy time of the year[8]. Because of this, balanzan fruits are often harvested by adolescent boys, whose labor is more efficiently used on such a task.

There are three different approaches to using balanzan fruits as animal fodder. First, ssomeone can go out into fields with small ruminants and guide them to the trees with ripe fruits. The fruits fall easily in the wind, but there is also a tool, a small hook on the end of a long bamboo pole, used for shaking limbs and making the fruits fall. Secondly, one can go out to the fields with the pole and a sack, gathering up fallen fruit and take it back to penned animals. Thirdly, one can gather up fallen fruit and may be able to sell it to someone back in town who lacks the time to send a family member out collecting, but has the interest and cash to purchase the nutritious fruit.

In Madiama, a cash-market for harvested balanzan fruit has only developed in recent years. As with most economic exchanges, prices vary depending on the part of the fruiting season and the negotiating skill of those involved in the exchange. The market is small and casual, often based on incidental encounters between buyers and sellers, but it shows how a

[8] Balanzan fruiting season coincides with the end of the rice harvest season, which usually runs from December into early-January, give or take, if there is a rice harvest at all. Immediately following the rice harvest is the construction season. Bricks must be formed and mud crepicing on the outside of houses and courtyard wall must be done while there is still water in the bancotieres, which, depending on the rainfall and the depth of the bancotiere, might last until February, give or take.

subtle change in management, can ripple through the agroecology and economy. The protection of balanzans will contribute to soil fertility, inasmuch as healthier and more plentiful trees fix more nitrogen in the soil. The production of balanzan fruits contributes to intensive herding of small ruminants, which has been identified by agricultural economists as the sector of the economy in Madiama that produces the greatest multiplier effect in terms of local wealth generation (Brewster, et al. 2005). This is not even factoring in economic exchange for locally and sustainably produced fodder.

Despite its benefits, the change in balanzan cutting practices has not been without its difficulties. The mayor says that while the ban was widely respected in its early years, there has started to be some backsliding more recently. Once, on a visit to the home of a leading NRMAC member, I saw a large pile of balanzan branches in his goat pen, and saw other villagers walking past with bundles of balanzan branches presumably heading for their compound. When confronted with this, he told me that they had blown down and had not been cut. It is true that balanzans are known to be particularly brittle-limbed, and this story is possible. However, free-ridership is also tempting. And as the mayor pointed out "No one is in the habit of turning in their neighbors to the law. If we, from the Mayor's office, don't see it, it will never be punished".

Burtol: Access and management of the cattle trails.

The trail used by Fulani herders to bring cattle to into and out of the Delta, called *burtol* (Fulfulde, pl. *burti*), is perhaps the most significant example of contested tenure in the Commune of Madiama. The trail that passes through Madiama enters the commune from the east, just south of Siragourou and north of the stream that also runs across the commune, called the Jama (Bambara) or the Yamé (Fulfulde). This same trail extends all the way into Burkina Faso in the east. The trail parallels the stream to Promani, where it veers northwest toward Nouna. Passing

Nouna, it leads to a small pasture in the floodplain of the Bani River. This pasture was described to me as a "waiting zone", a place where herds can descend to pass a short amount of time before traversing the river and entering the inner delta. As in other parts of the country, Fulani herders in the Commune of Madiama complain that the cattle trail has been diminished through the progressive installation of fields along the traditional path. They say that the trail used to be much larger, including both sides of the Yamé all the way to Nouna. Marka farmers in the commune dismiss this claim as a thing of the distant past. The trail has been diminished in recent decades through the installation of fields by residents of Madiama, Siragourou and Promani, fields that were granted by the various village chiefs. In addition to the existing trail, herders say there used to be a second trail across the north of the commune, running by Bangassi, before linking up with the other trail in Nouna. This second trail, I was told, is completely planted over in fields by residents from Bangassi and Tatia, and effectively no longer exists.

The degradation (as it would be characterized by the herders) of the *burti* is a result of changing power dynamics in relation to land management. Just by creating the trails, the Dina established the precedent of centralized state ownership and management over this particularly important land resource. However, unlike the case of the *jowros* of the inner delta, no one was granted ownership over the trails in and out of the delta. The twice annual use of the trails, under the management of a Fulani regime, was sufficient means of keeping them open during the era of their establishment, especially in a time when a much smaller percentage of the land was under regular cultivation. Following the Dina, the trails remained open by custom, convention and the simple acts of use.

Under the French colonial regime, all land "without a master" became property of the state, a policy maintained by post-colonial regimes. The rationalized transhumance, from

common property areas in the uplands down to *de facto* private property in the floodplains, was originally established by a central state authority (the Dina), but was managed by the *jowro*. Informants commonly stated that under the dictatorship of General Moussa Traoré (1968-1991), the pastures, the cattle trails and the transhumance itself fell increasingly under state management.

> It used to be that around the end of September, animals would descend to the bourgou. These animals were better looking. This changed since the time of Moussa Traoré. Since Moussa, it is more organized by the state, with fixed dates, governmental meetings, mayors, etc.

Locally, different informants indicated that the cattle trail through Madiama falls under the provenance numerous different positions: the village chief of Nouna, the various village chiefs along its path, the mayor of Madiama, the herders who use it, and various actors in the federal government such as judges, forestry agents, the *Sous-prefet* and the *Prefet* under whose jurisdiction the Commune of Madiama falls. No one other than the village chief of Nouna himself and Fulani residents of Nouna, claimed that the chief of Nouna has managerial rights over the trail, this despite the fact that the traditional tenure systems makes him the *dugumakolotigi.* According to his own description, he at least holds enough sway to kick people out of the section of trail that runs around his village.

> In 2002, I took a cart from the highway at Promani, 18 km to clear the trail of fields. I removed fields myself. I didn't wait for any other authority. When I took something from someone, I gave them something similar elsewhere. Because they got fields from me, and I can give them others.

The Nouna village chief's claim to ownership over the trail is supported by the Fulanis who live in Nouna, who have a vested interest in his power. No one else I spoke to readily acknowledged the chief's role in managing the trail. This shows how the power of the chief of the land has diminished in the Commune of Madiama.

> The trail is property of here, the village of Nouna. The trail follows the Yamé which belongs to the chief of Nouna. So, effectively, from the Bani to here and following the Yamé to the highway all belongs to the chief of Nouna.

The problem of fields in the trails as described by of by four different government officials below, reveals the convoluted and unclear nature of tenure and ownership of the cattle trails leading in and out of the delta.

> Reopening the trails needs to be negotiated with those farmers in the trail so that they can make a living and the path is functionally open. We have to recognize that that is valuable. Villages, communes, circles and regions are all called on to find the best formula. Also, representatives of the state and the service technique must be involved. And religious leaders too. Also, it is necessary to evaluate pastoral resources, their size, capacity, etc, and trust their management to local authority.
>
> These paths have existed even since the Dina. Everyone knows this. They are usually 80-100 m wide. They are known by convention and consensus, but there isn't any law that recognizes them directly. But the state recognizes the right of use by the herders. A village chief can give out fields, but not in the paths. It would at least be provisional. The mayor could override it. The *sous-prefet* could also override it. If a peasant cultivates in a path, he needs to recognize that he is taking a risk and that the path belongs to the herders. All land belongs to the state and the peasants and villages have rights of use, but they have to give it up to greater interests like paths.
>
> The village chiefs managed affairs within villages and between villages. Now the mayor manages affairs between villages, though he has no say over land conflicts. He cannot legitimately decide arguments. He can reconcile the parties or send the matter up to a *Sous-prefet* of a judge of the peace. Ever since 1986 or 1991 (can't remember) questions of land conflict should officially be decided by a judge.
>
> [The cattle trails] are covered within the *Code Forestiere*. It used to go through the *Chefs d"Arrondissements*, but now goes through mayors. No, not the village chiefs. Then to a forestry agent, who does some research on the area, possible conflicts, etc. Then, he finally accepts or rejects a field's presence in any given location. The forestry agent for Madiama is based in Sofara. That is the official formula. But, no, it rarely happens that way. *Eaux et Forêts* doesn't have the means to enforce their own rules. Most enlargements of fields are actually illegal because they haven't followed these rules. The Dina designated the paths throughout the Delta and it is for the mayors and circle officials to enforce the guard the trail so that it remains free of fields. . . . When problems reach me, it shows that problems have not been well managed by the religious chiefs, the villages chiefs or the mayor. We have told the mayors to enforce the law regarding the protection of the paths. Yes, herders have the rights to bring communes and villages to the law in order to make the fields that have been illegally installed in the trails leave.

Even those responsible for making and enforcing land-management laws are neither clear nor in agreement on who has rights and responsibilities over the cattle trails. Because of the broad spatial scale of their production strategy, transhumant herders, arguably the trails' primary user-group, are often not present to make appeals for what they see as their resource. Due to their current relative lack of political power, pastoral resources are quickly being converted to agricultural resources. As one Fulani herder put it, "Ever since Sekou Amadou, this trail has been

here, but it is not enclosed, so the fields enter. Not the governor nor the mayor nor anyone has interested themselves in closing it, protecting it".

Discussion and conclusions

Historically, tenurial claims have been a process through which power is exercised by interested parties. The current socioecological organization of the Macina area is the result of a strong power grab by the Dina in the 19th century, which asserted Fulani dominance over land use in and around the NRID. Subsequent power regimes have honored the structures of tenure put in place by the Dina, except where their interests conflicted. The colonial government and post-independence governments have claimed eminent domain in order to install flood-controlled *casiers* in the interests of national food security, wresting control over valuable floodplains from previous managers. As central authorities have weakened, local authorities such as village chiefs have been able to assert their power to open fields in areas that had previously been cattle trails or pastures, even though the fields are there illegally. Decentralization formalizes local power in the hands of mayors offices. The devolution of power to local mayors has, in effect, increased the power of village chiefs. Without the threat of force, which rests with central authorities, mayors can be hard pressed to influence the decisions of village chiefs. Mayors may even be reluctant to contradict village chiefs' decisions because it could affect their reelection interests. The power dynamics that have been present throughout history will continue to play out in this new policy context.

Case studies from Madiama illustrate that access to resources – such as fields, trees, pastures, and trails – is strongly rooted in social history. This is not to say that tenurial claims are not dynamic, but that the dynamism is connected to both the historical reference points that ground such claims as well as the contemporary processes that shape them. Contemporary

tenurial practices are based upon ancient customary regimes, which were subsequently were elaborated upon by the Dina, the French colonial administration, and post-independence governments. Rather than entirely replacing their predecessors, each new regime has built upon previous iterations, such that today they mesh into a multi-layered system that simultaneously establishes land rights and provides avenues to contest them.

> In the Delta, the links between its occupants and the land is well established by a code of rights which guarantees the hold of some groups over fields, pastures and water resources. The Mali legal code has not replaced [the traditional] system; it has absorbed the older system but has not opposed it (Cissé 1985).

The clarity of the contemporary code of rights governing land tenure system is debatable, especially under the current policy of decentralization, which adds a new layer to the system. The guarantees mentioned above by Cissé are only as good as one's ability to enforce them. Every system of land tenure reflects power relations. After centuries of subjugation, Fulani herders organized and the Dina took political power in the southern delta. The most significant enduring outcome of this regime change was that Fulani secured control over the highly-valued land resources of the bourgou pastures in the inner delta. This control was gained through the militarily-enforced exclusion of the farmers and fishermen who had an interest in the same land. While Fulani *jowros* still hold great power in the inner delta, the less-firmly secured land resource around the delta have increasingly fallen under the control of sedentary farming communities. This has gradually occurred through changing policy regimes and appears to be accelerating under decentralization. Outside of the delta, pre-Dina customary land tenure is largely in the control of farming communities which settled the area long before Fulani sedentarized, or even arrived in the region at all. Decentralization puts more power over land-management in the hands of these farming communities. Consequently, the maintenance of herders' trails and upland pasture resources depends on the natural resource management

decisions of farming communities that have tenurial claim over upland pasture areas. Alternatively, herders' access to trails and pastures may depend on the willingness and ability of the central government to intervene in the management of these spaces.

The *approche terroir* puts power over natural resource management in local hands, but it also assumes clear boundaries between territories and clear tenure. However, the communal boundaries of Madiama, drawn under Malian decentralization reform, do not coincide with the resources over which villages in the commune have tenure. The action spaces of pastoralists, fishermen and even farmers frequently fall outside of the domains of their home villages. There are many instances where resources used by or belonging to a village are not within the village's boundaries, or even in their own commune. This discrepancy stems from deeper history of resource tenure systems. Because the *approche terroir* has been laid over existing tenurial systems, it may add more confusion to land tenure questions. Many of the fields that belong to Kessedougou but are currently farmed by residents of Madiama are actually located in the Commune of Madiama, but belong to Kessedougou due to its historical place in the settlement of the region. Even though decentralization and the *approche terroir* put power over natural resource management in the hands of communes that are locally governed, it is unlikely that these policies will reduce power struggles over access to resources. In situations where many production behaviors are not undertaken within clearly bounded territories, the *approche terroir* may even exacerbate the contestation of resources.

CHAPTER 6

LOCAL KNOWLEDGE OF SOILS

The historical and political processes surrounding access to and rights of control over land form important parts of the social milieu in which technical environmental knowledge is situated. Recent ethnopedological literature challenges researchers to link technical knowledge with these broader political strategies and historical trends of land management (Niemeijer and Mazzucato 2003; Oudwater and Martin 2003). Utilitarian theories of ethnoecology hypothesize that subsistence niches and social positions influence the nature and organization of technical environmental knowledge in individuals and cultural groups [Nazarea-Sandoval, 1995 #605; Ellen, 2002 #544]. In central Mali, herders and farmers have long had different positions in the historical ecological and political landscape. This chapter contributes to ethnopedological literature by examining relationships between subsistence niches, cultural ideologies and cognition of the environment.

The ethnoecology survey (Appendix 1) focused largely, but not entirely on soils. Basic questions about upland pasture management and farmer-herder conflicts were also included. All of the questions pertained to knowledge of natural resources used in farming and, to a lesser extent, herding. I chose to have field assistants administer the survey in the interest of consistency and speed. I would have been capable of administering the survey in Bambara, but do not have sufficient skill in Fulfulde to do so. My field assistants were both SANREM research technicians and had ample experience conducting research in the area, so were well-qualified to conduct this survey.

The field assistants conducted test interviews with key informants to help train them and to evaluate the clarity and length of the survey, which was revised accordingly. My field assistants both agreed that an interview with even the most talkative of respondents should not last more than 2 hours, and ideally should take between 60 and 90 minutes. If interviews lasted any longer, the respondents' fatigue and annoyance would start to rise and the quality of data would decline. After a couple of revisions, which streamlined the structure of the survey, my field assistants started interviewing from a stratified random sample of the Marka and Fulani households in 5 villages. The Marka sample was drawn from Madiama, Promani and Tatia and the Fulani sample was drawn from Nerekoro, Promani and Nouna. One field assistant was responsible for administering the survey among the Fulani sample, and the other was responsible for the Marka sample.

My field assistants wrote all responses in notebooks which I provided to them. The Marka responses were written in Bambara, while the Fulani responses were written in French, with the exception of key words, such as soil names. I decided to have my field assistants write out responses because I deemed this more efficient and effective than taping interviews for four reasons. First, I discovered on my initial research trip that tape recorders are unreliable in the sandy, gritty environment of central Mali. Even if the ubiquitous grit does not destroy a tape recorder completely, it can introduce audible distortion that renders recordings useless. Second, a tape recorder can be an intimidating piece of technology. I found that using a tape recorder introduced a tension and terseness in responses. While people were familiar with, if not accustomed to, taped music or sermons, virtually no one I met had ever been recorded themselves. Keeping the interview to pen and notebook maintained a better atmosphere of familiarity and comfort. Third, the questions in the survey called for responses that were short

enough to be written out easily. None required long narrative responses that would have been unmanageable to write. Finally, using pen and paper bypassed the need for transcription and translation of the Fulani interviews, which I would have been unable to do myself.

Marka Ethnopedology[1]

Soil typology

As shown on the Marka ethnopedological chart (See Appendix 2), the domain name for soils in Bambara is *dugukolo* (sometimes said *dugumakolo*). Both terms carry the same meanings, at least in the Bambara spoken in Madiama[2]. *Dugukolo* is a compound word, combining the words *dugu* and *kolo*. *Dugu* translates as "the land", though it can also be used to refer to a village or a region. In this way it is similar to the English word "land". In some contexts, the word *dugu* itself can be taken as referring to soil, but in order to be completely clear, it is best to add *kolo*, which in this sense means "essence". *Kolo* also means "bone", "nut", or any hard part of something. For example, *kuma* means "speech", making *kumakolo* mean the essential aspect of what someone has said, the "point". *Dugukolo* refers to the essential aspect of the land, meaning soil.

No respondent listed more than three primary soil types. There are three fundamental categories of soils for the Marka in the Commune of Madiama. These are *bɔgɔ*, *cɛncɛn*, and *bɛlɛ*. These translate as clay, sand and gravel, respectively. A full 100% of informants cited *bɔgɔ*, and *cɛncɛn* as soil types, with another 45% of respondents adding *bɛlɛ* as a third. Thirteen percent of respondents list *tagɛ* as a primary type of soil, but their descriptions of the soil indicates that *tagɛ* is considered either as a mix of red and black clay, or synonymous with red clay. *Tagɛ* is always

[1] The size of the Marka sample was 38. All percentages are out of 38 unless otherwise indicated.
[2] I was repeatedly told that the Bambara of the Commune of Madiama is not "good" Bambara. It is rural and far from the Bambara cultural and linguistic center of Segou. Also, as will be explained further in Chapter 7, most of the Bambara-speaking population in the commune comes from other ethnic origins, meaning Bambara was adopted as a first language relatively recently, probably only the last few hundred years.

listed in association with *cɛncɛn* and *bɔgɔ*. Because of these descriptions, I have not included it as a primary soil type, but it will be addressed in the discussion section. Thirty-two percent of the Marka respondents did not cite any subcategories of soil.

Sixty-three percent of respondents identified subcategories of *cɛncɛn*. Forty-seven percent of respondents cited the existence of *cɛncɛnfin* (black sand), 18% cited *cɛncɛnbilen* (red sand), and 8% referred to *cɛncɛnjɛman* (white sand). When red sand or white sand was mentioned, black sand was always also mentioned, but red and white sand were never cited together by the same respondent. There was only one instance where a respondent mentioned red or white sand without also mentioning black sand as well. Sixteen percent of respondents mention black sand as the sole subcategory of soil, with no other subtypes of sand or clay.

Sixteen percent of respondents listed subcategories of sand based on texture or particle size rather than color. Three respondents distinguished sand subtypes of *cɛncɛnkunba* (large sand) and *cɛncɛnmisen* (small sand). Three other respondents describe *cɛncɛnmukumuku* or *cɛncɛnmakan*, which both mean “supple” or “soft” sand. One of these three used *cɛncɛnmakan* in opposition to, *cɛncɛnjalan*, which means “hard” sand. The other two respondents distinguished *cɛncɛnmukumuku* in opposition to *cɛncɛnkunba* or *cɛncɛnfin*.

Thirty-seven percent of respondents identified subtypes of *bɔgɔ*. Of all the respondents who listed any subcategories of *bɔgɔ* had *bɔgɔfin*, “black clay”. Twenty-four percent of informants cited *bɔgɔbilen*, “red clay”. One informant offered a subcategory of *bɔgɔfin*, which he called *bɔgɔkirikiri*, signifying “very dark, black clay” (*kirikiri* is an adjective meaning “very dark”, and used exclusively in association with the color black). No other subcategories of *bɔgɔ* were listed.

Only 5% of respondents made any distinctions of types of *bɛlɛ*, both of them distinguishing ordinary *bɛlɛ* and *bɛlɛkuru* (also called *bɛlɛfarakuru).* Plain *bɛlɛ* is described as being gravel being suspended in a medium of clay and/or sand. The two informants who distinguished *bɛlɛkuru* described this as being purer gravel with a significantly lower degree of sand or clay medium.

> *Bɛlɛ* is composed of soil and gravel. *Bɛlɛkuru* is largely made of gravel, with less soil and more gravel.

Soil characterizations

The typological chart shows how respondents use nomenclature to label soil types. This leads to the question of what qualities are associated with each category and how are they used to distinguish one type from another. As is common in ethnopedological systems around the world (Talawar and Rhoades 1998), Marka in the Commune of Madiama use color, texture, porosity, water retention to distinguish soil types from one another.

Respondents characterized *cɛncɛn* in general by its porosity, ease of cultivation, low natural fertility and poor retention of organic matter/fertilizer (*nɔgɔ*). *Cɛncɛn* is associated with millet, peanut and watermelon cultivation and is typically associated with higher elevations in the landscape, as illustrated below (see also Appendix 2).

> *Cɛncɛn* is less strong in *nɔgɔ* and doesn't hold all the *nɔgɔ* that one puts there. It leaches out quickly. One can cultivate it when it is dry.

> *Cɛncɛn* is a soil that has no plasticity. When a big rain comes, it becomes solid. It takes in water very easily and cultivating it is easy, even when dry. It loses force easily. It doesn't hold *nɔgɔ. Cɛncɛn* is found on the tops of elevated ground.

To distinguish different varieties of sand, respondents, say that *cɛncɛnbilen*, red sand, is a pure sand and is in some ways interchangeable with the overarching category of *cɛncɛn*. It is

characterized by its porosity, ease of cultivation and its low capacity to hold organic matter (see also Appendix 3).

> *Cɛncɛnbilen* is low in *nɔgɔ*. It is a soil that filters water easily. It has a red color and is easy to cultivate.
>
> *Cɛncɛnbilen* is very light and very permeable. One can even cultivate it when it is dry. It is a leached soil and requires a lot of manure because it is very poor on *nɔgɔ*.

On the other hand *cɛncɛnfin*, as a subcategory of *cɛncɛn*, is described as holding water and organic matter longer than *cɛncɛnbilen.* This is attributed to the fact that it is actually a mix of *cɛncɛn* and *bɔgɔ,* so takes on some of the qualities of the latter, including the recommended cultivars, particularly sorghum (see also Appendix 4).

> *Cɛncɛnfin* is made of *cɛncɛn* and *bɔgɔ*. When wet, it holds together in a mass and becomes very muddy. In the dry season, it creates a crust that has a lot of cohesion. *Cɛncɛnfin* is found along the sides and at the bottom of slopes.
>
> *Cɛncɛnfin* is *bɔgɔ* mixed with *cɛncɛn*. It is drier than *cɛncɛn*, but not as much as *bɔgɔ*. When it is wet, it sticks together and it isn't easy to farm. When it is dry it is difficult to work. It is good for millet and sorghum.

Bɔgɔ, clay, is most often characterized by its hardness when dry, its stickiness and malleability when wet, the slowness with which it absorbs water, and its high natural fertility. *Bɔgɔ* is found in lower elevations, such as in the floodplain and other places where water pools. It is typically associated with rice cultivation (in inundated zones) and sorghum cultivation (in non-inundated zones) (see also appendix 5).

> *Bɔgɔ* is a dry soil. It requires a lot of water. In the rainy season, it doesn't moisten easily, but when it has become wet, it goes a long time without drying. It takes fertilizer and holds it for a long time. It is good for rice and sorghum. It has plasticity.
>
> *Bɔgɔ* is black, but it isn't dark black. *Bɔgɔ* has plasticity and it doesn't take on moisture quickly. When it has dried, contracts and cracks open. When it has dried it is difficult to cultivate, but also when there is a lot of water it is not easy to cultivate.

Bɔgɔfin is characterized by its richness in organic matter, the difficulty of working it (both when dry and wet), its malleable texture (when wet), the slowness with which is takes up water,

its location in lowest spots in the landscape. Rice is cultivated in *bəgəfin* if the area is inundated and sorghum if it is not in an inundated zone (see also Appendix 6).

> *Bəgəfin* has a black color and is rich in *nəgə* and gives better yields. This is a soil generally covered with vegetation which gives a lot of *nəgə* to the soil. *Bəgəfin* holds water for a long time. *Bəgəfin* is found in zones where water accumulates.

> *Bəgəfin* is a strong soil it is less porous and holds moisture for a longtime. It is generally covered with vegetation.

Bəgəbilen is characterized by its red color, lower levels of *nəgə*, crusting on the surface and its location around the edges of inundated zones and depressions in the landscape. It is more strongly associated with sorghum cultivation than rice cultivation, because it is found just outside inundated zones. Some informants also suggest that it is well-suited to millet cultivation.

> *Bəgəbilen* does not receive the benefit of the standing water. Vegetal debris doesn't have the time to decompose in the soil. It is like sandy areas, but only the sand is permeable and lets *nəgə* descend deeply into the soil.

> *Bəgəbilen* is found where crusts form and has very little *nəgə*. It is hard and difficult to dig when it is dry. *Bəgəbilen* forms a belt around depression and low areas.

Tagɛ is a soil type listed by 13% respondents as a primary soil type, and two other respondents did not list it as a soil type unto itself, but offered it as an example of a place where soil types mix. These respondents generally agreed that it was a form of *bəgə*, but did not agree exactly which type or mix. Among those who refer to *tagɛ* as a primary soil type, two said it was synonymous with *bəgəbilen*, but two others said it was a mix of *bəgəbilen* and *bəgəfin*. The fifth said it was a mix of clay and sand. The other two agreed that *tagɛ* is a mix of *bəgəbilen* and *bəgəfin.* Descriptions of its location around the perimeter of the inundated zones and depressions indicate that it is effectively the same as *bəgəbilen*. This is supported by descriptions of its suitability to sorghum cultivation and crusting on the surface.

> *Tagɛ* is *bəgəbilen*. It is hard and it holds together. It has more *mana* than *bəgəfin*. *Tagɛ* is found around the floodplain. *Tagɛ* holds moisture. Sorghum is farmed there.

> *Tagɛ* is a mix of *bəgəfin* and *bəgəbilen*. It is less hard than *bəgəfin* and *bəgəbilen*. It permits water to descend into it.

> *Tagɛ* soil is *bəgəbilen*. It is otherwise the same as *bəgə*. *Tagɛ* is at the edge of the floodplain.
>
> In *tagɛ* soil, you usually mix millet and sorghum. It is a soil that is very often bare [of plants]. Water descends into it easily. I dig holes in *tagɛ* soil because it has a layer that holds out water.
>
> *Tagɛ* is a mix of *bəgəfin* and *bəgəbilen*. It isn't as heavy as *bəgəfin* alone or *bəgəbilen* alone. It is also more permeable to water than either *bəgəfin* and *bəgəbilen*.

Bɛlɛ is often described as being of poor quality for cultivation. *Bɛlɛ* is characterized by high amounts of gravel suspended in a medium of sand and/or clay. The gravel is hard on farming tools and does not hold organic matter. Because it typically located on the highest elevations and it is packed and crusted, water tends to run off of it to lower zones.

> *Bɛlɛ* soil is found high up in rocky areas. Gravel particles are bigger than those of sand, so its very dry. Water runs over it. There are a lot of places that are crusted over *bɛlɛ* soils. Farming *bɛlɛ* is difficult.
>
> *Bɛlɛ* is a packed soil. Sometimes rocks are found beneath it. There are more rocks than sand. Water runs over it. It is difficult to cultivate because crops don't do well in it. *Bɛlɛ* is found on the plateau and in high places.

The typological chart is useful heuristic tool for a researcher or development worker, but to what degree does it actually represent cognition? Processes of change, anthropogenic or non-anthropogenic are absent. Also absent are opportunities for representing knowledge of blurred boundaries. Despite naming so many soil types, 60% of respondents stated that soil types mix in the landscape. The characterizations of soils highlights the fact that named categories are not the same thing as discrete phenomenon in the landscape. In some descriptions, especially those of *cɛncɛnfin* and *bɛlɛ*, respondents observe that these types of soils are actually mixtures of elements of primary soils types.

Explanatory models of soil fertility

Much ethnopedological literature discusses the fact that soil fertility is a concept that may or may not translate into folk agroecological knowledge systems (Erickson and Ardon 2003; Gray and Morant 2003; Niemeijer and Mazzucato 2003). In Bambara, the concept of soil fertility

is expressed in the word *fanga*[3]. Following the free lists and characterization of the soil types, respondents were asked to rank order soil types according to their strength (*fanga*), and then explain what makes some soils stronger than others.

The concept of *fanga* is constructed using several variables. The amount of organic matter (*nɔgɔ*) in the soil is central among them, but is not the only factor. Soil color, particularly its blackness is an indicator of strength, and is associated with the presence of organic matter. Also included in the concept of a soil's *fanga* is its plasticity (*manaya*), which refers to a soil's ability to absorb and retain water. A soil with *mana* is supple when wet and can be manipulated without falling apart, but absorbs water slowly. Clay is the best example of a soil with a lot of *mana*. A soil's need for water is another factor commonly associated with strength. Clay is seen as having a greater need for water. "Need" in this sense refers to the quantity of water necessary to make a soil workable. For example, the heavy clay of the floodplain needs to absorb a large amount of water to become workable, whereas sandy soils need very little or no water to be workable. According to folk knowledge, the greater a soil's need for water, the greater its strength. Another factor in a soils *fanga* is its ease of cultivation. The easier it is to cultivate, the lower its strength.

Nɔgɔ – organic matter
Manaya – plasticity
Water "needs"
Ease of cultivation

Figure 6.1. Key aspects of strength in soils: Marka

> The main causes for the difference in force of soils are generally the richness of *mana* and *nɔgɔ* in the soil and its needs for water. And also its resistance to farming tools.
>
> If plasticity is in the soil, it is very strong. There is no plasticity in *cɛncɛn*, and it has little strength. *Nɔgɔ* sticks to *mana*.

[3] *Fanga* can translate as "strength", "power", "effectiveness" or "force", and is not used exclusively in reference to soils. It can also be used in reference to physical, social, or political-economic strength. For example, there is a popular film about women in Malian society titled *Taafe Fanga* or "Skirt Power". *Fanga*, contracted to *faa*, is the basis of the common words *faama* ("rich or powerful person") and *faantanya* (poverty, lit. "the state of being without power"). Throughout my discussion of soils, I have chosen to use the word "strength" as my preferred translation.

One-hundred percent of informants list *bɔgɔ*, or a subtype of *bɔgɔ*, as the strongest type of soil. Twenty-four percent of respondents specified *bɔgɔfin* as the strongest soil type, with one respondent saying *bɔgɔbilen* was the strongest. The consistency in ranking quickly breaks up past this point. Out of seventeen respondents who list *bɛlɛ* as a soil type, nine of them rank it higher than *cɛncɛn*. The other eight rank *cɛncɛn*, or a subtype of *cɛncɛn*, higher than *bɛlɛ*. As discussed above, a soil's plasticity is associated with its strength. It is this quality that led to so may respondents citing *bɛlɛ* as stronger than *cɛncɛn*. While gravel alone does not have much plasticity, *bɛlɛ* soils are often characterized as being gravel in a medium of clay and/or sand. The clayey aspect of *bɛlɛ* soils is what gives them their plasticity and capacity for water retention. As one respondent put it, "*Bɔgɔ* likes water more than *bɛlɛ*, and that likes water better than *cɛncɛn*".

While the crustiness of *bɛlɛ* causes water to run off of it, the crust also holds moisture in, as opposed to sand, which is described as taking up water readily but also drying quickly. "*Bɛlɛ* soils are always moist, they dry very slowly". Due to its physical properties, *bɛlɛ* is typically cultivated in a different fashion than *bɔgɔ* or *cɛncɛn*. When *bɛlɛ* soils are cultivated, instead of plowing them, farmers dig small pits in the soil. Fertilizer and seeds are then added to each pit individually. The pits are dug out several inches deep to create a reservoir that retains water at the base of the plant, compensating for water's tendency to run over the crusted surface.

Knowledge of Fertilizers[4]

Nɔgɔ is the Bambara word that can be glossed as either "fertilizer" or "organic matter", depending on the context. The basic characterization of the relationship between plants and nɔgɔ is that plants eat (*dun*) *nɔgɔ*. As in human cuisine, Marka knowledge of *nɔgɔ* holds that not all foods are of equal nutritional value. As a part of the ethnoecology survey, I asked respondents to

[4] Statistical measure in this section is based on N=34, as there is no data from 4 respondents out of the original 38.

free list kinds of fertilizer (*nəgɔ*) and then rank the items on their list in order of strength (*fanga*). The range of answers included small ruminant manure[5], cow manure, horse and donkey manure[6], chemical fertilizer (known as *tubabu nəgɔ* or *engrais*)[7] and household refuse. Manures are collectively known as *farafin nəgɔ*, literally "African fertilizer". Outliers include one respondent who listed chicken manure (which he ranked first) and two respondents who listed compost[8]. Twelve percent of respondents list animal manure as a single general category and did not elaborate or subdivide it. The fact that some informants did not distinguish between cow and small ruminant manure makes comparison of the data slightly problematic, but I chose to let this stand in order to maintain the integrity of the free list exercise. If some informants do not feel there is a distinction to be made, they should not be forced into doing so for the sake of easing data analysis. The fact that some people do not make that distinction is itself data, as it indicates something of their perceptions of the topic.

Eighty-two percent of Marka respondents describe small ruminant (goats and sheep) manure as being the strongest form of fertilizer. Only two respondents (6%) said that cow manure was stronger than small ruminant manure, using the reasoning that "Corralling cows [in

[5] Domesticated animals are collectively known as *daaba*, a category that includes cows, sheep, goats, horses, donkeys and camels. Goats and sheep are collectively known as *dabamisen* (lit. "small domesticated animals"). Goats and sheep are typically managed together, so their manures are effectively inseparable. On the occasions where a respondent distinguished the two, they were ranked side by side and the responses were collapsed into one category.

[6] Some respondents listed horse and donkey manure separately and some listed them together. Because horse and donkey manures were described as being qualitatively similar, I have chose to lump them together into one category for the purposes of this research.

[7] Chemical fertilizers are called *tubabu nəgɔ* (white people's fertilizer), or by the French *engrais*. Respondents were not asked to distinguish specific varieties of chemical fertilizer.

[8] Household refuse (*sununkun nəgɔ* also known as *ɲamiɲami*) includes the items swept up by women within the household courtyard. This can include ashes, corn cobs, dust, peanut shells, used tea leaves, plastic sacks, sticks, leaves some random animal manure, virtually anything. This is different from compost in that it is not watered and managed to facilitate decomposition. It is simply put in a pile somewhere out of the way (occasionally in the way) and transported out to the fields prior to planting season. Compost (*digɛn nəgɔ*), on the other hand, is intentionally produced and intensively managed to promote thorough decomposition. Active production of compost is a technique that has been promoted recently in Mali. It is difficult, however, in the village of Madiama due to poor water supplies (in terms of quantity and quality) in the dry season when compost most needs watering. Composting is a technique that is known but is not widely practice in villages included in the survey.

a field] is valuable as a fertilizer mostly because the urine and solid manure holds tightly to the soil". Small ruminant manure is said to be effective in the soil for 3-7 years (depending on respondent, and concentration of manure applied to a field), whereas cow manure is said to last no more than 2-3 years. Somewhat surprisingly, chemical fertilizer was most often ranked last because its effects only last one season, though one respondent ranked it first, saying "The ways of making *tubabu nəgɔ* make it well suited to crops and soils, but if you don't have money, you aren't able to get it". In fact, many respondents did not initially include it on their list of things that are *nəgɔ*. In the event that chemical fertilizer was left off, the fields assistants who administered the survey were instructed to ask the respondent why they did not included chemical fertilizer in their list.

Following the rank ordering, respondents were asked to explain the reasons why some fertilizers are stronger than others. Numerous respondents offered explanatory models that reveal a great deal about their perceptions of landscape interrelationships and ecological processes. While not everyone's explanatory model shows the same degree of detail, no one offered any models using contradictory or competing rationales.

> Small ruminants eat tree leaves which have roots that descend very deeply. They take up *nəgɔ* and water during the entire year. Cows eat grasses, which are not as hardy. They are alive at one moment and then at another moment they are dead.
>
> Trees take up nutritive elements from deep in the soil during the entire year, and small ruminants eat their leaves. Also, the leaves are chewed well and better digested by small ruminants. Cows only partially chew their food, which isn't well digested in their insides. Their manure contains things that aren't well digested.

Many respondents in the ethnoecology interviews did not initially list chemical fertilizer in their free list of fertilizer types. When asked why, they typically said they do not use it because it is too expensive for them. Chemical fertilizers are seasonally available in the markets in the village of Madiama and elsewhere, but they are not often used on subsistence crops. One key informant said the reason for this is that since you don't make any money on subsistence

crops, spending money on growing them is just losing money, or at least risking money for no financial gain. It is best to invest money where more money can be made. For example, chemical fertilizer is nearly always used when growing watermelons, the major local cash crop. A small dose of is put in the soil around the seeds at planting to promote vigorous early growth. But chemical fertilizer is not without its risks. In low rainfall years, chemical fertilizer can burn (*jeni*) crops.

> All *farafin nəgə* lasts in the soil longer than *tubabu nəgə*, but for immediate purposes, *tubabu nəgə* is very strong. It doesn't last more than one year. The way that *tubabu nəgə* is made suits crops, which is why is satisfies people's immediate needs.
>
> You have to know the techniques for this sort of [*tubabu*] *nəgə*. Above all else, the doses. If not, it can be a factor in the destruction of the crops. It is a *nəgə* that is better than *farafin nəgə*, but which requires that you understand a lot of things.

Despite recognizing the significant impact of chemical fertilizer can have on production, Marka farmers consistently ranked it last in terms of its strength, even behind uncomposted household refuse. The rationale is based on the amount of time that chemical fertilizer continues to be effective after application. A recurring theme when characterizing chemical fertilizer is that it is produced for immediate effects and has no long-term impact. It is generally described as lasting only one growing season. Though only one respondent out of 38 ranked chemical fertilizer as being stronger overall than animal manure, it was still recognized as a powerful suppliment to manure for short-term production goals, as illustrated by this characterization: "*Farafin nəgə's* strength is greater than *tubabu nəgə* because of the amount of time it lasts in the soil. But if you were to use them together when growing millet, *tubabu nəgə* is stronger than *farafin nəgə*".

Chemical fertilizer's high utility under optimum conditions is counter-balanced by the risks of damage under the condition of low rainfall. The focus on the strength of manure, as evidenced by the duration of its effect, runs contrary to the popular portrayal of African farmers

as planning and managing on a short time horizon. If it were true that they managed their resources on a short time-horizon, one would expect to find that they would place greater value on the resource that would give them the highest return in the shortest time. Instead, estimates of fertilizer strength and soil fertility management are discussed on a scale up to seven years, showing that farmers' knowledge of and management of soil fertility considers a long time horizon. Ethnographic interviews support this position, indicating that farmers keep track of when manure has been applied in fields, and to what parts of fields, over the course of many years. The low ranking of chemical fertilizers compared to organic fertilizers also reveals a risk-averse approach to soil fertility management. Although chemical fertilizers can produce large benefits, they can also damage crops under conditions of low rainfall, in which case a farmer would have spent a lot of money on fertilizer that actually reduces production. Manure, on the other hand, is much less likely to burn crops during a drought[9], and will still be effective during the years following a draught.

Discussion of Marka ethnopedology

One of the first things one notices upon looking at the Marka ethnopedological chart (see Appendix 2) is that both *cɛncɛn* and *bɔgɔ* are typically broken down on the same principle: color, specifically black, red and white. Moreover, black is the most frequently mentioned, then red, then white. The black color is strongly associated with soil fertility (*fanga*). Soils in Mali, like most of West Africa, are high in iron and tend toward a reddish hue. As such, dark color is a noteworthy characteristic in a soil. Texture, as a nomenclatural element, is present, but is not as prevalent as color. The use of textural modifiers does show, however, that particle size is a variable quality worth mentioning even within the general category of sand.

[9] Manure only burns crops when it is applied too densely, which is rarely a problem.

The main deviation from the *bɔgɔ-cɛncɛn-bɛlɛ* trio of primary soil categories was *tagɛ*. *Tagɛ* is construed as either synonymous with red clay or as a mix of soil types, but the component parts are not uniformly agreed upon. Four out of the 5 respondents who mention *tagɛ* are from the village of Tatia[10], toward the north end of the commune. The fifth is from Promani. None of the respondents from Madiama, who comprise the majority of the sample, mention *tagɛ*. This may be a function of differences in local soil types, but it may also illustrate how naming systems can vary between villages.

Cɛncɛnfin, the single most frequently cited and highly valued soil subtype, is consistently described as a mix of *cɛncɛn* and *bɔgɔ*. In casual conversation, most Marka I spoke with said that *cɛncɛnfin* is their favorite kind of soil to farm because it combines the best qualities of both sand and clay. This is especially noteworthy, as *cɛncɛnfin* is not considered to have the greatest strength (*fanga*). The sand gives it a high porosity and a texture that is easy to cultivate while the clay gives it *fanga*, water retention and capacity to hold organic matter. By planting both millet and sorghum together in *cɛncɛnfin*, farmers exploit its mix of qualities to hedge against environmental uncertainty, specifically variable rainfall.

Pure *bɔgɔ* requires a high amount of water before it can be cultivated, meaning that in years of low rainfall it is not a useful soil. On the other hand, in years of very high rainfall, if sandy soils receive too much water, millet will not thrive. *Cɛncɛnfin* has intermediate qualities due to its intermediate position in the landscape, making it productive under a broader range of conditions due to planting strategies. Because millet thrives in dry sandy soils and sorghum thrives in more clayey, water-saturated soils, both millet and sorghum are commonly planted together in *cɛncɛnfin*. If rainfall is low, the millet will thrive and the sorghum can be thinned. If

[10] The stratified random sample is such that there were only 5 respondents from the village of Tatia.

rainfall is high, the sorghum will thrive and the millet can be thinned. *Cɛncɛnfin* is also highly valued for peanut production because they benefit from the mix of qualities from the two soil types: higher organic matter and water retention caused by the clay and the loose texture caused by the sand. Due to these management strategies, *cɛncɛnfin* is the most reliable soil in terms of giving a decent harvest in any given year.

Like *cɛncɛnfin, bɛlɛ* is also described as a mix of essential soil elements. Although the name *bɛlɛ* literally means "gravel", this type of soil is obviously not pure gravel. Gravel is simply the salient feature by which it is named. It is actually gravel suspended in a medium of sand and/or clay. One respondent even said that *bɛlɛ* and *cɛncɛn* are essentially similar: "*Cɛncɛn* is similar to *bɛlɛ*, but its grains are much smaller".

What initially emerges from the ethnopedological research is a nomenclatural system identifying soil categories that appear to be distinct. However, in-depth investigation shows that while people use names as references for idealized categories, they simultaneously recognize that these categories do not exist as discrete features in the landscape. Instead, people see a landscape in which there are several variables for the soil in any given location and those variables shift across the landscape creating gradients of qualities rather than true types. One key informant summed it up by saying

> Well, to tell the truth, there is sand in all clay soils, and some clay in all sandy soils, but the quantity changes. Sometimes there is a lot and sometimes there only a very little.

The examination of folk knowledge of fertilizers builds upon the soil characterizations to touch on processual aspects of soil ecology. Folk models explaining differences in fertilizer strength indicate that Marka farmers cognize agricultural soil fertility as being linked with numerous broader ecological processes, spanning diversity in animal biology (difference in

digestive functions), plant physiology (nutritive values of foliage, root morphology, life cycles), and ultimately, deep soil characteristics (movement of water, nutrients and organic matter).

Referring to this explanatory model, I asked several key informants how soil fertility functions outside of human management, which is to say without the direct addition of manure to the soils. They said that if a soil is not farmed, grasses, leaves and twigs will slowly decompose, often with the help of termites, and descend into the soil. Wild grasses and trees take up these nutrients more slowly than domesticated grains, so soil strength is able to increase, albeit very gradually. This explains, from a folk perspective, why fallowing restores soil fertility but also why it is insufficient under the conditions of heavy use. It also explains how uncultivated places in general continue to be productive. Cultigens are seen as pulling up nutrients from the soil more quickly, so fertilizer/organic matter must be added to maintain productivity.

Fulani Ethnopedology

Soil typology[11]

The domain name for soils in Fulfulde is *leydi* (pronounced like the English "lady"). Much like the Bambara word *dugu*, the word *leydi* can be used to refer to soil, to a region, or a country (though not a village). The designated administrative units governed by *jowros* are called *leydi*. *Leydi tubaku* refers to the countries of white people. *Namaku* alone means "hot pepper", *ɲamaku leydi* is the word for ginger roots, literally meaning "hot pepper from the soil".

The Fulani ethnopedological chart (Appendix 13) shows that 100% of Fulani respondents listed clay (*boko, lopal* or *popolal*) and sand (*seno* or *ndiarindi*) as primary types of soil. Fifteen percent only listed only these two as primary soil types, while 69% listed a third primary soil type. After *boko* and *seno*, the third type mentioned varied between one of two possibilities.

[11] The Fulani sample size is 26 and all percentages in this section are derived from that total unless otherwise indicated.

Forty-two percent listed *fero* as the third type of soil, while 27% cited *kaje* (also known as *karawal or korkaje*) as the third type. *Fero* and *kaje* are closely related types of soil, as will be shown in the next section. For now, I will gloss *fero* as "gravel" and *kaje* as "hardpan". Fifteen percent of respondents listed four primary soil types, including both *fero* and *kaje* in their responses. Finally, one respondent listed a soil he called *kolongual*, which he described as an intermediate type between *fero* and *seno*. However, another respondent listed *kolongual* as a synonym for *boko*.

Forty-six percent of respondents did not include any subcategories of soils. Respondents who listed 2, 3, and 4 primary categories were all among those respondents who left their typology at one level. Among the four primary categories of soils, *boko* was the most frequently subdivided. Fifty percent of respondents cited at least one subcategory of *boko*, whereas only 35% subdivided *seno*. Only one informant who gave subcategories did so for *seno* without also doing so for *boko*. *Boko* was subdivided into *boko balejo* (black clay, 50%), *boko bodejo* (red clay, 35%), and *boko caheri* (whitish-yellowish clay, 4%). *Seno* was likewise subdivided into *seno bodejo* (red sand, 35%), *seno balejo* (black sand, 19%), and *seno caheri* (whitish-yellowish sand, 8%).

Soil characterizations

The Fulani soil typological chart shows how respondents use soil nomenclature to label soil types. The Fulani characterize these soils primarily according to porosity, color, workability. *Seno*, also known as *ndiarindi*, is characterized by ease of cultivation, high porosity, poor

retention of organic matter[12] and its location at relatively high places in the landscape (see also Appendix 14).

> *Seno* is the type of soil that occupies the most space and in which we cultivate millet generally. This soil is easy to work and holds more moisture when it rains less. *Seno* occupies areas less elevated than *fero* and crusted with sand. *Seno* become poor quickly and it is necessary to bring manure all the time.
>
> *Seno* is the soil that occupies the large part of the commune. It is characterized by its red color and the fact that it doesn't hold water for very long. It is weak because it is farmed so much by the farmers.

Boko, also known as *lopal*, or sometimes *popolal* or *kolongual*, is characterized by its hardness (when dry), natural richness, low porosity, difficulty of cultivation and location in low places in the landscape (see also Appendix 15).

> *Boko* is a hard soil to cultivate especially when it doesn't rain often. It is rich because it the in low areas where rain water concentrates, so it doesn't need you to bring out manure every year. *Boko* is found in areas where rain water drains to, like the rice fields and ponds, *bancotieres*.
>
> *Boko* is also called *popolal*, it is found in low zones where water run off pools. Because of that, it doesn't need a lot of manure every year because it is rich. We plant sorghum or rice there. It is hard to cultivate and needs a lot of water to be able to work it. *Boko* is found in low areas, in the plain.

Boko balejo, or black clay, has the qualities of clay as discussed above, plus a black color and an even stronger association with low zones in the landscape, particularly inundated zones.

> *Boko balejo* is good for producing rice, or sorghum if it isn't underwater.
>
> *Lopal balejo* is found in the rice fields to the west.

Not all respondents agreed that *popolal* is directly interchangeable with *boko*. Thirty-five percent of the respondents listed *popolal* as synonymous with *boko*, but for a couple of respondents, *popolal* is a more specific type of clay, and not the dark one that is found in the rice fields and associated with high natural fertility. Instead, it is characterized in a way that is more consistent with *boko bodejo*, red clay, especially its color and location in the landscape. Between

[12] The Fulfulde word is *birji*. When used on its own, I have translated it as "organic matter", but it can also be combined with an animal name to indicate composted manure. There is a different word, however, for raw manure, which is *ɗondi*. In this way, the word *birji* is used much like the Bambara work *nɔgɔ*.

the two respondents below, one listed *popolal* as a subcategory of *lopal*, the other listed *popolal* as a primary type of soil, and then listed *popolal baleri* (black *popolal*) as a subcategory of *popolal*, implying that the primary kind of *popolal* is not black.

> *Popolal* is reddish-yellowish and is found on banks like along the Yamé or the rice plains. We don't work this soil. *Popolal* is found along the Yamé and toward the ponds in the west.

> *Popolal* is a soil black or whitish of the type that one finds on banks or in low areas/seasonal ponds. It is richer in organic matter than other types of soils. It also holds more water than other types of soils, but to produce well, it has to receive a lot of rain.

Furthermore, one respondent used *kolongual, popolal* and *boko* interchangeably through the course of his responses. However, another respondent cited *kolongual* as an intermediate soil type between *fero* and *seno*, taking clay out of the description entirely

> *Kolongual* is good for growing millet. It is easy to work, and holds more moisture and doesn't need a lot of water. *Kolongual* is found in slightly depressed zones.

Fero is characterized by its gravelliness, red color, low porosity and surface crust, low fertility, lack of natural vegetative growth, location in high places in the landscape. The construction of rock lines is a technique that helps retain moisture and organic matter in this type of soil.

> *Fero* is a type of soil that we don't cultivate. It is poor and doesn't hold moisture, because water runs over it due to the hard pan. *Fero* is found in hard areas on elevations.

> *Fero* is a soil that is hard, red and poor in organic matter. Some don't like to cultivate it because of its lack of strength. It drains water because it is compact. It is difficult for grasses to grow in this soil. *Fero* is on the plateau, particularly high areas of the plateau.

Descriptions of *kaje* (singular form is *haïre*) are very similar to those of *fero*. Most respondents appear to use the two interchangeably, but four respondents listed both of them separately, indicating that at least some people see a distinction. *Kaje's* primary characteristics are that it has a crusted surface over which water runs and is most often bare of vegetation.

> *Kaje* is a soil very difficult to work. In order to do it, you have to make *gaiki*[13] in the dry season. It rarely grows grasses or bushes. It produces less and needs a lot of rain.

[13] *Gaiki* (Ful.) are stone lines built over hardpan. This is a soil conservation technique promoted by the government and INGO's. It is designed to slow runoff of organic matter and water, permitting regeneration of the soils.

> *Haïre* is a mix of red gravel. It is poor and is found only in a few parts of the commune. When it rains, the water drains off of it, which is why we make rock lines on it [to stop the flow of water]. It is a soil that needs to have manure added to it every year. *Haïre* is found on elevations, such as that found between Madiama and Nerekoro.

All but one of the Fulani respondents said that soil types mix in the landscape. All of the different primary categories are said to mix, though the most frequently mentioned is the mixing of *boko* and *seno*. The most frequent example of this is *boko* plus *seno*, mentioned by 83% of the Fulani respondents.

> There is *boko* plus *seno*. If there is a lot of clay and some sand, the soil is less hard, easier to work than soil that is only clay. But if there is more sand than clay, the soil is even easier to work than mostly clay, and water sinks into the soil more quickly. It is mostly sorghum that we plant (in the sand-clay mix) and often millet.

> *Ndiarindi* and *boko*, this is a soil more or less black or red, according to whether sand or clay dominates. Also, we cultivate millet and sorghum together, because it is a soil that succeeds no matter what the quantity of rain falls in a year.

The second most common mixture of soils is *fero/kaje* plus *seno*[14], which was described by 50% of Fulani respondents. *Fero/kaje* plus *boko* was also cited as an example of soils that are found to mix in the landscape.

Explanatory models of soil fertility

Following the soil typology and characterization, respondents were asked to describe what makes some soils stronger than others and to rank order soils in terms of their strength. Seventy-five percent[15] cited the generic *boko* or *boko balejo* as the strongest of soils. Of the remaining 6 respondents, 3 cited a mix of *boko* and *seno* as the strongest, which was then always followed by *boko*. Two

Table 6.2. Key aspects of strength in soils: Fulani
Birji – organic matter
Rainfall
Location in landscape

[14] For the purpose of this section, *fero* and *kaje* are lumped together, as they were used interchangeably by most Fulani respondents

[15] 18 out of 24 respondents. There is no data for this question from 2 survey participants.

respondents said that seno was the strongest of soils, and one respondent refused to rank order the soils, saying "Both *seno* and *boko* have force, but it depends on the rain".

The Fulani respondents characterize soil strength as a function of the interrelating variables of organic matter (*birji*[16]), rainfall and location in the landscape. Rain and rain runoff transports organic matter downhill, resulting in concentrations of both water and organic matter in low-lying areas of the landscape.

> It is the rain, by the power of God, because if it rains, the water pools in the low zones and drains the organic matter from the sand. That is what makes *popolal* stronger than the other types of soil. For example, the soils on the plateau are not as rich as those in the low areas.
>
> The reason for more or less force is that *seno* is more on the plateau than *boko*. If we put manure in the sand, the water will drain it toward lower parts of the ground. It is also that even if we don't put manure in *boko*, it is stronger than *seno*.

Soil fertility management

The Fulani word for fertilizer and organic matter is *birji*. In the fertilizer free-listing and rank ordering exercise, the Fulani respondents listed goat and sheep (small ruminant) manure, cow manure, household refuse (*tiddere*) as the most common responses. It is again important to note that a major portion of the sample (23%) did not distinguish different types of manure, simply offering animal manure as a generic category. The outliers on the list were horse and donkey manure (1), chicken manure (1) and balanzan leaves (1).

There was only moderate agreement among Fulani respondents regarding the strength of fertilizers. While 50% of respondents said that small ruminant manure ranked as the best fertilizer, another 23% of the respondents did not distinguish between small and large ruminant manure and another 15% ranked cow manure as being stronger than small ruminant manure. Thirteen percent ranked chemical fertilizer, *birji tubaku*, as the strongest.

[16] I translate *birji* differently depending on the context. If its application to fields is the result of human management, I will use "fertilizer", but if it is as a quality of soil independent of human management, I use "organic matter". The word *birji* works just like the Bambara word *nɔgɔ* is this sense.

The most frequently mentioned differences between the two sorts of fertilizer, *birji* and *birji tubaku*, are that *birji* lasts longer in the soil than *birji tubaku*, which does not last more than one year. Some respondents note that chemical fertilizers affect the quality of the fruits and grains, altering the taste of the foods. Finally, animal manure is available for free, whereas one has to buy chemical fertilizers.

> Goat and sheep manure are balls that degrade little by little and their decomposition can take years. That is the reason that it lasts, while *tiddere* and cow manure are already dusty and dissolve very quickly in the soil.

> The corralling of animals makes manure and urine and then the footsteps of the animals mix it all in the soil. This lasts 2-3 years in the soils or more. *Birji tubaku* doesn't pass one year. Household refuse and manure that we transport loses a part of its force before the transport and decomposes less quickly because the mixing [into the soil] is slower. In the case of corralling animals in fields, the soil becomes so strong that we rarely see striga[17] in the fields, whereas with the other kinds of *birji*, striga might appear.

Those who favor cow manure as strongest cite a variety of reasons. They say cow manure's strength is a function of the high volume of manure, the inherent strength of cows as large animals, and the practice of corralling cows in fields. One Fulani even uses the inverse rationale of those who favor small ruminant manure, citing that cows' diet of grasses gives their manure greater force. While the reasoning still falls on the same variable, the animals' diets, the values are gauged inversely.

> Cow manure is stronger because the manure of one single animal is worth that of several goats or sheep. Also, if you corral cows in your field, the production is great. The stalks of the plants are more vigorous.

> Cow manure is worth more than goat manure. Goats eat the leaves of trees, which is the base of their diet. Cows eat grasses, so the two things [cow and goat manure] aren't the same. Even sheep live like cows so their manure is worth more than goats'.

A full 50% of the Fulani respondents said outright they had no experience with chemical fertilizers, mostly because they were too poor to afford them, but a few said they had no need or interest in them because they had access to a sufficient quantity of manure through their herds.

[17] Striga (*Striga hermonthica*) is a plant that parasitized the roots of grains such as millet, sorghum and maize. It is a major agricultural problem in the Commune of Madiama and throughout sub-Saharan Africa. Crops grown in low-fertility soils are more susceptible to striga parasitization than crops grown in high-fertility soils.

Despite lack of experience, there is a basic second-hand knowledge of chemical fertilizers, as well as opinions about their relative value when compared with organic, "African fertilizers".

> What I've heard is that *engrais* is better than *birji*, but in my opinion, *birji* is better than *engrais* because *engrais* was made by the white people, while the manure and urine of animals is made by God.
>
> *Engrais tubaku* only lasts one year and affects the taste of the food. Though we don't use *engrais tubaku* so as to really know its force.

Discussion of Fulani ethnopedology

One of the first noteworthy aspects of the Fulani soil nomenclature is the presence of the word *boko*, a borrow word from the Bambara *bɔgɔ*. This is not a unique instance of exchange between Bambara and Fulani languages in the local milieu but there is a certain pattern to linguistic exchange. Words tend to be borrowed when referring to things that come from the domain of the cultural group from whose language the word is borrowed. For example, the cattle trails, such as the one passing through Madiama, are called *bagantɛmɛsira* (lit. "trail for cattle passage") in Bambara and *burti* in Fulfulde. A corral for the enclosure of cattle is called as *sinsan* in Bambara and a *garbal* in Fulfulde. However, it is not uncommon for Bambara speakers in the village of Madiama to use the Fulfulde words for corral and the cattle trails because they are seen as being a part of the Fulani milieu, because herding is construed as a Fulani activity. Likewise, the adoption of the word *boko* in the Fulani milieu suggests a belief that working with soils is an activity appropriate to the Bambara-speaking milieu. It may also stem from the fact that the *rimaiɓe*, the former slave class in Fulani society who have historically served as farmers for their Fulani owners, are usually at least conversant in Bambara. Presumably, the sedenterized Fulani who have recently adopted agriculture have done so with the help of insights from the local *rimaiɓe*. While there are few *rimaiɓe* in Nouna, both Promani and Nerekoro have numerous *rimaiɓe* families.

Another noteworthy aspect of Fulani soil nomenclature is that there are several soil names that have conflicting meanings. While the meaning of the borrow word *boko* was very consistent, its Fulfulde counterparts were much more variable in their definitions. Conflicting descriptions of *popolal* and *kolongual* indicate that either the soil naming system is not well defined or it is not widely shared across Fulani population.

Most informants use *kaje* and *fero* interchangeably. Sixty-nine percent of respondents mention one of the two, but another 15% cite both *kaje* and *fero,* indicating that some people draw a distinction between the two. The four respondents who cite them both describe them as very similar, the difference lying in which aspect of the soil is emphasized. *Fero* soils are primarily characterized by their gravelliness, while *kaje* soils are primarily characterized by their crusted surface. Their similarity is highlighted by the fact that all informants refer to the same parts of the local landscape for examples of both soils, i.e., between Madiama and Nerekoro, near Toumadiama or to the east of the commune.

The Fulanis' discussion of soil strength is based on the continual downhill flow of organic matter, *birji*, through the soil. Organic matter may be the result of natural decomposition or the direct addition by people, but it is always carried by the flow of rain runoff. This is consistent with the perception that low lying areas have the strongest soils. The heavy focus on the rain echoes Fulani narratives on pasture quality and pasture management, which will be discussed in Chapter 8. This narrative can be summed up as "If the rains come, everything grows and the cows eat well and all is well".

Fulani assessment of soil amendments is highly varied. In the section on soil fertility management, respondents frequently mention corralling animals, particularly cows, in fields, revealing a key Fulani approach to soil fertility management. Having relatively high access to

herds, whether their own or those of their friends and neighbors, Fulani agricultural practice in Madiama relies heavily on direct application of manure in fields by the cows themselves, as opposed to collecting it in the household and transporting it out to the fields. Corralling animals in the fields is made possible by virtue of the fact that Fulani who farm do not generally farm large fields nor many fields, enabling many of them to more richly manure their fields through their own herds.

Comparison and conclusions

Both Marka and Fulani use the same perceptual categories to categorize soil types. Soil color and consistency form the two primary levels of categorization for both ethnopedological systems. Despite basing their nomenclatural systems on the same principles, the labels for specific soils do not necessarily translate across their languages. While the shared usage of the perceptually salient features of consistency and color supports universalist ethnobiological theories, the differentiation by subsistence strategies' land-use patterns supports utilitarian theories of ethnoecology, illustrating how technical environmental knowledge can be shaped by environmental use practices. The Marka, who are traditionally farmers, have a more developed and more shared nomenclatural system for soils than the Fulani. The presence of textural names in the Marka system, while not prevalent, still indicates a more intensive interaction with soils. Textural names are most likely to develop among people who have their hands in the dirt more often. The Fulani nomenclatural system is not as elaborate nor as widely agreed upon as the Markas'. However, there is a greater acknowledgement of mixing of soils types by the Fulani, indicating a notion of the dynamism of soils in the landscape.

Data shows that the ethnopedological systems of the Marka and Fulani in Madiama share the same general outline. Sand, clay and gravel form the primary components of soils. A much

higher percentage of Fulani included gravelly soils as a primary soil type, and a few even distinguished two variants, *fero* and *kaje*. *Fero* and *kaje* are both soil types that are associated with highland environments, especially ones that do not readily lend themselves to cultivation and so are not farmed as frequently as clay and sandy soils. Inasmuch as they are not often farmed, *fero* and *kaje* soils are increasing used as pastures for herds, especially goats, who prefer woody species that survive, if not thrive, in *kaje* and *fero* soils. As such, the Fulani are likely to have more intimate experience with such environments, so it is not surprising that they would have greater differentiation in their knowledge of that environmental feature. The Marka, who look at soils from the perspective of farmers, see only a soil of marginal utility regardless of whether gravelliness or crusted surface is the predominant feature. It is also possible that because the Markas have been longer established as farmers, they are less likely to have to farm such marginal soils, whereas the Fulani, who have only seriously taken up farming in the last generation or two, may not have as much access to the better soils.

Marka and Fulani respondents named many of the same subcategories, splitting sand and clay into red, black and white. The most frequently mentioned subcategory of sandy soils for the Marka was *cɛncɛnfin*, black sand, while the Fulani most cited *seno bodejo*, red sand. On the surface, this might make it appear that the Marka and Fulani see different kinds of sand as important, but further examination shows that they are speaking about the same things in different terms. Respondents readily agreed that *cɛncɛnfin* is actually a mix of sand and clay, with the clay giving the black color to the otherwise reddish sandy soil. The Fulani did not name black sand frequently, but they frequently referred to instances where sand and clay soils mixed. As previously mentioned, much of the sand in the area of Madiama is of a reddish hue due to the high iron content. For Marka, black sand receives its blackness from the presence of clay in it.

The Fulani reference to red sand is referring to the sand itself. The black sand mentioned by some Fulani is not a reference to the same soil that is called black sand by the Marka. For the Fulani, black sand is found higher on the plateau, and refers to a sand whose grains themselves are actually a dark color due to their parent material. Rather than folding the color, gained from the clay, into a named sand category, the Fulani do not place the mix into a category. Instead, they simply call it a mix of sand and clay.

Another interesting parallelism between Marka and Fulani ethnopedology is that they both have difficulty agreeing on how to describe the same type of soil, that which is called *tagɛ* in Bambara, and called *popolal* by some in Fulani. Both Marka and Fulani describe these as soils with crusted surfaces that are found at the edge of flood zones. Both the Marka and the Fulani associate this soil with sorghum cultivation. Among the Marka, *tagɛ* was variably described as synonymous with red clay or as a mix of red and black clay. For the Fulani, *popolal* was sometimes used as a generic for clay, but was also sometimes used specifically to refer to a soil found on the edges of wet zones, described as being variably reddish or whitish or blackish. I interpret the ambiguity that is shared by Marka and Fulani populations as being a function of the soil's condition at the boundary between inundated and non-inundated zones. Both Marka and Fulani recognize that it is a soil between two distinct hydrological environments and having mixed, making it difficult to categorize.

The Marka overwhelmingly estimate small ruminant manure to be stronger than cow manure. There was much less agreement amongst Fulani, 25% of whom said cow manure is the strongest. The Fulani's relatively high estimation of cow manure's strength may stem from a variety of causes. Cows are highly valued as a prestige symbol in Fulani culture. While herding small ruminants is held in higher regard than farming, it does not have nearly the prestige of cow

herding, and this prestige may contribute to Fulanis' higher valuation of cow's manure. Alternatively, the high estimation of cow manure's strength may be a function of Fulani's style of practice of agropastoralism. The Fulani in the Commune of Madiama tend to farm small fields exclusively for household needs, directing their economic and labor surplus into cattle. As one Fulani informant told me. "We farm millet, sorghum, a little rice, maybe peanuts and beans in order to feed ourselves. We don't cultivate watermelons or calabashes or such [cash crops]. We don't seek money in our fields". The small field size and high rate of herd ownership has led to the Fulani relying more on corralling animals in fields as a mechanism for maintaining soil fertility. As such, Fulani's relatively high valuation of cow manure may be a function of their method of acquiring and utilizing it. Conversely, the typical soil fertility maintenance strategy for Markas is to keep small ruminants in the household courtyard, collect their manure, and then transport it out to their fields. This is much more laborious than the Fulani strategy, but is more adaptive to conditions of low cattle ownership than corralling.

Both Marka and Fulani ethnopedological systems incorporate notions of broad ecosystemic flows, though their constructions are not entirely the same. While both offer approximately the same explanatory model for differences in fertilizer strengths, their explanations for why soil types have different strengths vary. Both stress the importance of organic matter and rank clay, particularly black clay, as having the greatest strength. In addition to organic matter, Marka portray soil strength as a function of its ability to absorb and retain water and its resistance to cultivation. For Fulanis, the constant downhill flow of organic matter through hydrological action explains why clay, the soil found in low lying areas, is stronger than sandy soils. Finally, the Fulani heavily emphasize that soil strength is always contingent upon

adequate rainfall, which is an act of God. If God sends the rains, plants grow better, indicating and creating strength in soils.

CHAPTER 7

IDENTITY AND SUBSISTENCE STRATEGIES

Development professionals have been encouraged to move away from using ethnicity as a primary identifier of target populations. Instead, subsistence strategy has become the preferred marker, as ethnic identity is often associated with an idealized lifestyle image, rather than lived practice. The focus on actual subsistence practices makes sense in terms of tailoring development strategies to material conditions of rural peoples rather than the problematic and often contentious question of ethnic identity, which sometimes carries problems of inclusion and authenticity. However, cultural identities and their associated values should not be written out of analysis of interventions in rural production systems.

Ethnic identity is closely tied to subsistence niche in central Mali and must be considered in development interventions. Development professionals who look at Marka and Fulani production strategies may argue that both are agropastoralists, relying on a mixture of farming and herding to forge their livelihoods. This characterization, although accurate in its way, misses a large aspect of Marka and Fulani's lived experiences as agropastoralists. What does it mean to them to be agropastoralist? What does it mean to a Marka to own work cows and a small herd goats and sheep? What does it mean to a Fulani to cultivate millet, sorghum and beans? It is good and well to observe and measure how the Marka and Fulani incorporate diverse economic behaviors into their production strategies, but how do they construe the significance of each activity? How do the meanings attached to these subsistence behaviors fit into the aspirations for the future of rural development in central Mali? These questions are linked to broader questions

of what it means to be Marka and what it means to be Fulani. Although their subsistence niches have partially blurred together in recent decades, people's senses of identity, which encompass their idealized lifestyles and production behaviors, is carried on in ideological aspects of their subsistence strategies and natural resource management politics.

> One key to identifying and stimulating opportunities to affect Sahelian livelihoods positively will be a better understanding of the roles, limitations and dynamic relations between the various elements of the action spaces within which people construct their livelihoods. This understanding will need to address the perceptions of the groups that make up Sahelian populations concerning the range of potential opportunities and the factors determining the eventual configuration of action spaces. It will require a clearer picture of the changing structures for opportunity and constraint which Sahelian smallholders perceive and in relation to which they make decisions (Painter et al. 1994:459-460).

Material conditions of production play an important role in shaping "structures of opportunity and constraint" that are involved in decision-making. However, I propose that cognized models of the environment are also "structures of opportunity and constraint". Cultural ideologies, values that are embedded in ethnic identity and are passed down through cultural reproduction, inform people's strategic positions in constructions of meaning, ecopolitical debates and visions for the future. Cultural values, represented the third level of Rappaport's cognized models (see Chapter 1), address the place of self and culture group in the broader social ecology of interconnected subsistence strategies. These ideologies are dynamic through time and variable within any given population, but are still unifying aspects of culture that affect decision-making. Consequently, variation in cultural ideologies must be addressed when discussing development, even if they are not always satisfied.

The vast majority of the residents in the Commune of Madiama fall into the broad category of agropastoralist, though there is a long gradient within that category. This gradient ranges from farmers who own a couple of goats, to herders with over 100 cows who periodically cultivate a field or two. The furthest ends of the spectrum of production strategies in the Commune of Madiama remain pure farming and pure pastoralism: the poorest of farmers own no

animals and the wealthiest of herders do not cultivate fields. Despite this mixing of subsistence behaviors, cultural ideologies and values relating to subsistence practices continue in peoples' memories and constructions of ethnic identity. More importantly, they still affect people's perceptions of their social and ecological environments and guide decision-making and ecopolitical strategies.

For example, if a hypothetical farmer were to cultivate three fields and own 15 cows, his fellow farmers would most likely say he is wealthy. He is doing well enough to have money to invest in 15 cows[1]. A Fulani[2] with the same fields and the same cows would be seen by his fellow Fulani as being on hard times. His herd is so small that he has resorted to farming to make ends meet. As the farmer's wealth increased he would continue to invest in cattle, but he would do so while maintaining his fields as his primary means of production. As the Fulani's wealth increased, he would also invest in cattle, but he would likely do so while reducing his reliance on farming. According to key Fulani informants, the economics of herding is such that to make a living as a pure pastoralist requires a minimum of 50 cows.

> If a herder, a Fulani, has less that 30 head of cattle, he is poor, poor, poor. Once you get 50 or more, you are starting to do all right. A cow doesn't reach maturity until it is 7-8 years old, when it can get full price at a market. In a herd of 50, 15 should be calves, 20 should be females, milk cows, leaving 15 as adult males, not all of which would be full maturity.

Within the Fulani milieu, a Fulani with 50 head of cattle should not be considered rich, he should be seen as getting by. This assessment is according to Fulani ideals of wealth and lifestyle, meaning it should be assumed that they do not farm, do not want to farm, and should not have to farm. When a Fulani has to farm, it shows that he is hitting bottom. One of my informants

[1] Depending on the quality of the animal and market conditions, a cow in the Madiama market can sell for around 100,000 CFA (~ $200), a substantial sum for rural producers.

[2] Fulani culture is diffused in a broad diaspora from Senegal to Cameroon, and there is significant regional variation. For example, in northern Guinnea, known as Futa Jallon in the Fulani milieu, Fulanis are the dominant ethnic and linguistic group. In parts of southeastern Mali, Fulani have been sedentarized and have lost their language (largely through extreme persecution by local authorities and populations in the 18th and 19th century. The characterizations of Fulani culture found in this chapter, and throughout this dissertation, should be considered as addressing *at most* Fulani culture in and around the Niger River Inland Delta.

pointed out a field that has not been cultivated in 2 years because its owner is doing well enough with his herds that he has no need to bother with cultivation. The benefits of fallowing are incidental to the luxury of not needing to cultivate.

For Marka agropastoralists, cattle represent an augmentation of their livelihoods[3]. Cattle are investments of surplus capital, which was most likely gained from other productive activities, namely market-oriented agriculture or other forms of commerce. For Fulani agropastoralists, however, cattle have tremendous symbolic importance and represent the most culturally-valued means of economic production. Farming, on the other hand, represents poverty and hardship, as it is considered to be lowly work that is beneath the dignity of a good Fulani.

The differences between Marka and Fulani ideologies toward production behaviors stem from the particular historical pathways that have brought the two cultural groups to their contemporary condition of agropastoralism. The Marka's and Fulani's own construction of differences between them, their cognized models of social ecology, are expressed in the ways they describe themselves, each other, and their respective roles in the regional system.

Marka identity

Agriculture in central Mali has seen a massive transformation in the last 60 years. Until the mid-20th century, agriculture in the Madiama area was done by human labor, including soil preparation and transport of the harvest into town. This started to change in the 1940's and 50's, when governmental policies directly addressed agricultural productivity at the village level. This began with the introduction of the plow. This introduction was at first coercive, but as several informants observed, it didn't take long for people to recognize the benefits.

[3] Marka agropastoralists in the Commune of Madiama rarely herd livestock themselves. In my experience, actual Marka herding was limited to taking goats and sheep out to browse in the harvested fields during the dry season. During the rainy season, they hire Fulani to do the actual herding.

> The plow came here, the first time I saw a plow was with the Chef de Canton, sometime in the 40's. They were given to the Canton Chief and the village chiefs, and they were obliged to cultivate with them. Someone came to teach people how to use them. He was named Bokar. Starting from the 60's until now, they have become many. I got my first in 1959. I was among the first in the village, there may have been 5 or 6 others, but I paid for mine myself.
>
> In the last 55 years, a great change has taken place. Before, all work was done by hand. But around 55 years ago, the plow started showing up little by little, then carts. By 35 years ago, it had changed completely. Plows, carts, bicycles were everywhere. It was not since more than 20 years ago that watermelons have been grown as a cash crop.
>
> Around 1946, a plow was given to each village chief whether they wanted it or not. And we were forced to learn to use it. Now we go a long way to buy them.

Since plows and carts requires traction, farmers suddenly had need to own and keep working cows. Similarly, the rise of horse and donkey carts created a need for farmers to keep equines. The acquisition of carts and equines has occurred privately as well as through international development projects seeking to improve rural economic productivity though increasing farmers' ability to get produce to markets. Within the last 20 years, UNICEF implemented a program that financed the purchase of working cows and horse carts in the Commune of Madiama, a project that is remembered in the area as one of the most beneficial projects to ever come to the commune. In 1994-95, the World Bank funded Programme de Gestion des Ressource Naturelle (PRGN) gave 12 donkey carts to participating villages (which included several villages now in the Commune of Madiama).

Following on their increased economic prosperity, more and more farmers have taken to keeping goats and sheep as a way of storing and multiplying wealth. Farmers' wealth has also been augmented by commercialization of watermelon production, as mentioned in the quote above. Watermelons are indigenous to Africa, but the commercialization of "improved" varieties is relatively new to the region. The farmers in the village of Madiama have enthusiastically taken to producing watermelons for sale in Mopti and Jenné, as well as the local market. The adoption of cash cropping has led to greater cash flow for many farmers, which has contributed to the augmentation of cattle keeping by farmers, including the Marka.

The overarching theme in the development of Marka agropastoralism is that increasing fortunes have led to the adoption of cattle keeping. Animals have become a capital investment integral to agricultural production. In order to use a plow, there needs to be a cow. The use of horse and donkey carts to bring harvest in from the fields and to take goods to markets has also increased farmers' capacity to make money. This increased capitalization of agriculture was induced by the state and has been supported by INGO's, as well as the activities of individual producers. This technical shift has permitted farmers to reallocate labor toward market-oriented production in addition to their subsistence-oriented base. Increase in market-oriented production has increased the cash flow for farmers, making it possible for them to invest in livestock. Whereas cows, horses and donkeys are needed for production, goats and sheep represent small-scale investments with multiple benefits. Not only are small ruminants a form of wealth that can multiply relatively quickly, but they can be sold off to gain access to modest amounts of cash in order to meet needs. Finally, their manure has become an important part of soil fertility maintenance strategies as fallowing becomes less and less possible. In this way, even small ruminants can increasingly be seen as capital investments for agricultural production.

Throughout the adoption of cattle-keeping by Marka farmers, cattle have been a complimentary or supplementary aspect of their overall production strategy. Cows, horses and donkey aid directly in agricultural production, while small ruminants represent an investment of money gained through agricultural production. Still, despite the rising prevalence an desirability of cattle ownership, all of the Marka I talked to would identify themselves as farmers. But, what does it mean to identify oneself as Marka in the delta? Most other ethnicities in the region use language as a sign of cultural identity. However, unlike the Fulani, Bambara, Bozo, Bobo,

Dogon and Songhay in and around the delta, the Marka have not retained their ancestral language, but instead have come to speak Bambara.

Historically, Markas are of the Sarakolé ethnicity, the cultural and linguistic center of which is Nioro du Sahel, several hundred kilometers to the west of the delta. Gallais (Gallais 1967) observes that Sarakolés initially migrated to the Delta following the fall of the Mali empire in the 13th and 14th centuries. The label "Marka" is a transformation of the Bambara word "Malika", literally "person from Mali". These Marka were already practicing Muslims upon their arrival in the delta and are known as Marka *fin*, the black Marka. More recent arrivals of Sarakolé in the Delta are known as Marka *jɛ*, the white Marka. Marka *jalan* constitute the third category of Marka in the delta. Marka *jalan* are "Bambara or Bobo who accepted a veneer of Islamization in the previous century, during the reign of the Tukolor" (Gallais 1967:109). Residents of the commune of Madiama support this characterization. Consequently, Marka ethnic identity, in the Commune of Madiama and elsewhere, is highly permeable, with only a couple of broad identifying traits. Among my informants, the only two identifiers that are consistently associated with being Marka are being Muslim and being a farmer.

> Many of the families in Madiama who say they are Marka were originally from other ethnicities. Konaté[4] is usually a Bobo name around here. Koita is Bambara from around Segou. But over the years, they've become Marka. Their behavior and demeanor has changed.
>
> I'm a Marka. My father moved here from Segou. He was Bambara, but here in Madiama, we are all Marka
>
> When Marka gain cows, they give them to Fulani to herd them. Marka themselves don't herd cattle. We farm.
>
> Marka prefer farming to cattle herding. When you farm, you get millet to place in your granary. When you herd cattle, there is heat, there is cold, rain beats you and you sleep outside all the time. Fulani prefer these things.
>
> Every Fulani who farms, they don't have many cows. But their fields aren't big. If he has children, he can pass the nights in town and his kids will herd the cows. The Fulani can't farm well. Fulanis' work is cow herding. Markas' work is farming.

[4] Konaté is the name of the village chiefs in Madiama and Koita is another common family name in Madiama.

Being a farmer and being a Muslim are not exactly unique descriptors in the NRID. Aside from the Bobos, who are more numerous in the upland areas to the east of delta, nearly everyone in the region is Muslim, at least currently. Farming is also contemporarily practiced by many, if not all, ethnicities to greater or lesser degrees. However, a cross-hatch of predominant ethnic groups in the area and their historic roles shows an image of how the broad description of being Muslim farmers might be unique after all. Other than Markas, the most predominant ethnic groups in the area are Fulani, Bozo, Bobo, Bambara and Songhay. All of these groups have maintained their ancestral languages. The Songhay, whose cultural-linguistic center is located in the north around Timbuktu and Gao, arrived in the area as traders and are mostly found in the cities of Jenné and Mopti. Jenné and Timbuktu have historically been commercial bookends for trade up and down the river. According to some, Songhay is the unofficial language of the city of Jenné. The Fulani's strong affinity with their role as herders has already been well established and will be discussed at length below. Likewise, Bozos are strongly associated with their historical subsistence niche as fishermen and boatmen. Bobos, while being farmers, have largely resisted Islam and have maintained their traditional animist religion. This leaves the Bambara.

The Bambara villages in the Commune of Madiama fit the description of being Muslim farmers, but they have a cultural history of being Bambara to draw upon. The Bambara ethnic religion thrived well into the 19th century and continues to a lesser degree to this day. The Bambara kingdom of Segou, which was conquered by the French in the 1890's, maintained the practice of Bambara religion. I was not able to establish the time of conversion of the Bambara villages in the Commune of Madiama, whether it was recently, under the threats of the Dina and Tukolor in the 19th century, or if it had occurred prior to such external pressures.

The Bambara in the village of Bangassi, in the Commune of Madiama, actively maintain some ritual practices that are uniquely Bambara, though they now have a veneer if Islam on them. I attended a festival in Bangassi in December 2003, held only every few years and only following years of bountiful harvest. The festival involved a long series of dances performed by men wearing elaborate masks and costumes (resembling what Americans would call floats, but worn by people instead of cars). Secret rituals were interspersed with the dances. These rituals were performed in the middle of the crowd, but adult men stood around those performing the ritual holding woven mats to obscurre the views of non-participants. The effect was such that everyone in the crowd knew that there was something going on in there, but only those actually involved could see what it was. The secrecy of this part of the ritual was driven home to me as I was seated in the viewing area. I was explicitly and forcefully told not to get up and wander around, ane especially not to try to get a look at what was going on inside the wall of mats. All activities in the inner circle were only for the initiated to see. The continuation of this specifically Bambara ritual festival emphasized the constructed ethnic difference between the Marka and the Bambara. Despite sharing religion (at least at the present), and subsistence practices (agriculture), a cultural distinction is maintained between Bambara and Marka based on cultural history.

Though I never heard nor saw any evidence of ritual behavior that was distinctly Marka, the discussion of "becoming Marka" was something I found repeatedly, most often in reference to Bobos who converted. Enough Bobos maintain their own religion that a Muslim Bobo is a sort of contradiction in terms. In this area, one of the main identifiers of being Bobo is the practice of Bobo religion. Bobo religion is secretive and very closed, which is why outsiders are warned against entering Bobo villages during certain times of the year. I met one Bobo from

Kessedougou, just southeast of Madiama who had converted. While he remains a resident of the community, he was forced to move to the far outskirts of town so that he would not break the ban on outsiders in the village. While he has Bobo heritage, he also claims that by becoming Muslim, he was becoming Marka, at least partly. With the adoption of Islam, one can no longer effectively claim Boboness and other ethnic identities in the area. Referring to the village of Siragourou, it was pointed out that different branches of the same family can maintain different ethnic identities based on their religious affiliation.

> When a Bobo starts to pray (becomes Muslim) and lives with Markas and acts like Markas, one day he just say that he is Marka. For example, the Tera family in Siragourou is Muslim and are Marka. The Tera families in Kessedougou and Konesedougou are Bobo, even though they are the same family.

Another aspect of the permeability of Marka ethnic identity is how it relates to questions of class. Across Sahelian West Africa, there is a three part structure of social class. At the top, there are *hərən*, what translates usually as "noble". This does not indicate nobility in the same sense as it is used in Europe, to indicate royalty, but rather simply carries the connotation of a "free person" who is not a member of either of the other two categories. The second tier in the social system is the *ɲamakala*, or casted class. Included in this class are blacksmiths leatherworkers, griots (a combination of musicians, historians, praise singers). The *ɲamakala* are basically skilled professionals who are seen as below *hərən* because they make their livings in the employ of the *hərən*. Finally, there are slaves (*jən*) and the descendents of slaves *(woloso,* lit. "born in the house"). Slaves and their descendants, who also for all purposes remained slaves of the house into which they were born, were used as agricultural and domestic laborers. For example, weaving cotton cloth on handmade looms is specifically designated as slaves' work throughout West Africa. Members of each social class historically married only within their own social class, reproducing the social class structure. This is changing, but very gradually.

Ɲamakala, who inherit their professional social class, are considered to be without ethnicity, since their group affiliation is based on who is paying them. *Woloso*, their ancestors having lost their ethnic identity by having been taken as slaves, typically have adopted the ethnic identity of their owners. In Madiama, there are several large *woloso* families who had been the slaves of *hərən* families in Madiama for many generations. These families became Marka through association. The historical relationships between families and their former slaves are widely known and sometimes even invoked. While slavery has long since officially ended and everyone has officially become *hərən*, the knowledge of these class differences is still active in social life. For instance, *hərən* and *woloso* do not, as a rule, intermarry. There are a few known exceptions, but they remain just that, exceptional. Within the village of Madiama, there is a discourse of *woloso* families becoming *hərən*, mostly through the increase in family size, acquisition of wealth, and assertions of power.

> The Coulibalis [not real name] used to be of the former slave class, the *woloso*, but they've become more and more noble.
>
> The Traorés [not real name] came from Tatia. At first there were *woloso*, but they later became nobles.

Marka society shows highly permeable ethnic and class boundaries. In the southern NRID, it has become a catchall ethnicity that others can easily convert to. The first Marka arrived in the delta having already adopted Islam. Other ethnic groups in the region such as the Bozo, Bambara, and Bobo, had strong religious and ritual identifiers prior to Islam. When members of these ethnicities adopted Islam during the 19th century and before, they not only converted religions, but they converted ethnicities in order to break their associations with non-Islamic ethnic religions. This permeability is also apparent in class relationships in Marka society. Former slave class can become nobles, though this is difficult, slow and rare.

Fulani identity

The permeability of Marka ethnicity and class structure stands in marked contrast with Fulani society as I found it in the Commune of Madiama. Unlike Marka identity, which is open and permeable, Fulani identity is closed and narrowly defined, with several strong identifying characteristics that are tied to cultural history, subsistence, language, and symbolic structures. All of these cultural aspects color the Fulani's responses to their condition as agropastoralists and their aspirations for rural development in Mali. The first Fulanis arrived in the NRID in the 12th century as transhumant pastoralists from the area that is now eastern Senegal. Fulani immigration in to the NRID increased with the decline of the Mali empire in the 15th century (Niane 1989). Most Fulanis themselves lived a lifestyle of transhumant pastoralism up until the 19th century. The primary exceptions were those who pursued Koranic study and religious scholarship.

Transhumant Fulani herders have long exchanged cattle[5], milk and handicrafts[6] for grain, cloth and other goods. However, from the point of view of household economics, many transhumant Fulani could have technically been considered agropastoralists due to the fact that they kept slaves to cultivate for them[7]. Slave villages were located along transhumance routes so that there would be contact between owners and their slaves at least twice a year: once as the herds descended into the delta, which coincides with harvest season, and once as the herds leave the delta, which coincides with planting season. As in any culture with institutionalized slavery, slave-keeping is possible only for wealthier households. Among the Fulani, slave-keeping

[5] The exchange for cattle would have historically been for butchery purposes. Even today, there are no Fulani butchers. One informant explained to me that cattle are wealth, killing a cow is like destroying money. A Fulani may sell a cow to a butcher and buy some of the meat, but the Fulani only rarely kill cows themselves.

[6] The Fulani are known for their woven grass crafts, such as mats, baskets and screen "walls", to the point that one of the species most used in these crafts is known as *fulabin* in Bambara, literally meaning "Fulani grass".

[7] Unfortunately, I have not come across any indication in the literature of when slave-farmers became a prevalent part of the Fulani economy in the NRID nor the degree to which they contributed to Fulani subsistence. Based on the literature, all that can be said for certain is that this system was well established by the time of the Dina, in the early 19th century.

represented the investment of wealth in order to diversify modes of economic production. Agrarian slavery permitted wealthy Fulani to have the best of both worlds: they could live the transhumant lifestyle with their herds while benefiting from agricultural production within the household economy. This arrangement meant they were free to exchange their milk for luxury items rather than grain. Still, among the Fulani, agriculture was always supplementary to pastoralism, and above all else, it was work to be done by slaves.

The Dina attempted to sedentarize transhumant Fulani in the early 19th century in an effort to more thoroughly convert them to Islam[8], but mass sedentarization did not occur until the late 20th century. What finally sedentarized many Fulani was not governmental programs, but environmental change. In the 1970's and 80's, multiple withering droughts decimated Fulani herds, destroying their livelihoods and their lifestyle. In 1985, some areas lost 75% of their cattle and weak rainfall since then has not permitted full recovery (de Bruijn 1997). Many Fulani were left without means of production and their lifestyle was disrupted since there is no transhumance without herds to follow. Death of their herds forced many Fulani to settle and cultivate fields as best they could so that they and their families would have something to eat.

Although it is tempting to simply look at the Fulani's increased adoption of agriculture as a changing lifeway, the experience is more loaded for the Fulani themselves. Becoming a farmer is not just a new mode of subsistence, it is a fall from relative prosperity to a life of degrading labor. For a Fulani to personally, physically engage in cultivation, is to debase himself by doing slaves' work. Being an agropastoralist is a sign of just how bad things have become for them (de Bruijn 1997). This characterization was supported by my informants. Some Fulani have managed to rebuild their herds and live a transhumant lifestyle once more. Others, however, have never

[8] Even today, the Fulani who live on transhumance year round are considered more likely to be unconverted or not strictly-practicing Muslims.

fully recovered and remain largely sedentary. Farming is still something that Fulani do only out of necessity. For many, their aspirations lie in herding.

> I like cattle more than the town and my friends. If I were to get a herd of cattle today, I would head out into the bush tomorrow.
>
> Even here in [my village], Marka and Fulani are neighbors, but they don't intermarry at all. Their thoughts aren't the same. Our thoughts are about cattle herding. Herders and farmers, their thoughts cannot become one. Even me, if I were to get a herd of cows, I would not farm.

Even the suggestion that Fulani should diversify and invest some of their wealth in forms other than cattle meets resistance. One government official described how the problem with pastoralism in the region of Mopti (which is basically to say among the Fulani) is that it is too extensive and that the wealthy pastoralists keep all of their wealth in cattle. In the north, where Tomashek herd camels and donkeys, herds are small and intensively managed and additional wealth is put into harder capital, such as houses, shops and cars. He cites this as an adaptation to minimal pasture and water resources. He suggests that herders in the Mopti region should adopt the same model rather than building herds so big that there isn't enough pasture and water to sustain them without degrading the environment. When this idea was posed to a Fulani key informant, his immediate and emphatic response was simply "He is not the same race. We are not traders, we are herders. That is what we do".

The region of Mopti is known throughout Mali to be weak in education. According to many of the educated people I met in Madiama, this is closely linked to the prevalence of Fulanis in the region. Looking over the class lists for the schools in the village of Madiama[9], out of hundreds of students, I saw but a few Fulani names on the list, despite the close proximity to the Fulani village of Nerekoro. Fulani disinclination toward secular education may be partly explained by the difficulties of combining education and transhumance, but is also often ascribed

[9] The Commune of Madiama has four primary schools, one each in Madiama, Promani and Bangassi and Torokoro. There is a middle school in the village of Madiama that serves the entire commune. For any education higher than middle school, I student needs to leave town, usually to Mopti.

to cultural values, even by the Fulani themselves. Many Fulani see secular education as less valuable and less appealing that herding. In particular, it is seen as less important than Koranic education. Consequently, herding and/or Koranic education take priority over secular education.

> You have to understand that among the Fulani, if it isn't herding cows or studying at the Koranic schools, it isn't worth anything. That is why even today, even tomorrow, no Fulani send their children to school. The Fulani think that everything else is nothing. Why? I keep telling you, Todd Crane, its just like that among the Fulani.
>
> We don't send the children to school often because many people don't see the benefit and children generally don't like it. Children are happier in the pasture with the cattle. They prefer to be free.

The theme of freedom in Fulani culture is so strong that Riesman made it the title of his classic ethnography on the Jelgobe Fulani of the Gourma region[10], "Freedom in Fulani social life". Part of this "freedom" is in reference to the social constrictions of village social life, many of which are loosened, abandoned, or escaped while living in the bush on transhumance. The Fulani have such a strong sense of ethnic identity, and a corresponding belief in their difference from other ethnic groups, that they have a verb, *pulaade*, which means "to be or act like a good Fulani". The corresponding set of values, what might be thought of as the Fulani code, is called *pulaaku*. *Pulaaku* requires that men are stoic in demeanor and do not express strong emotions while in the village. Social etiquette sets many constraints on what can be done and said in front of whom while in the village. Riesman lists a few of these:

> One must not eat or drink before members of the opposite sex (possible exceptions: mother and sisters), nor before children, nor before in-laws or even in their *wuro*[11] (exception: the daughter in-law eats, of course, in the *wuro* of the parents in-law, but rarely in the presence of her mother-in-law), no in the *wuro* of the agnatic kin with whom one is not already linked by relations of a certain intimacy; on must not express any discomfort in public, whether it be a pain, physical or moral (such as grief), or a need (like hunger, thirst, or defecation). . . . In an extreme hypothesis, one would say that they Fulani ideal would be a man without needs (Riesman 1974:128-129).

---

[10] The Gourma is located around northern Burkina Faso and eastern Mali south of the Niger Bend, approximately 200 miles from the Commune of Madiama. Many transhumant herders from this area are sure to be found in the NRID during the dry season. It was also incorporated in the Dina and Tukolor Empires in Macina Riesman, Paul 1974 Freedom in Fulani social life: An introspective ethnography. M. Fuller, transl. Chicago: University of Chicago Press.. As such, I feel justifies my use of Riesman's work as a reference point for ideological aspects of Fulani culture in the Commune of Madiama. In contrast, Fulani cultural centers in Guinnea (Futa Jallon) and Senegal (Futa Toro) are much further away and much less comparable in terms of environment and lifestyle.

[11] In this usage, the best translation is "household"

If someone breaks a behavioral proscription, they bring shame upon themselves for their lack of *pulaaku*. Living in small villages, most people are usually near enough to so many relatives that it is easy to get caught in one of these impoliteness's if one lacks due diligence. Life out in the pastures with the cattle, however is a different matter altogether.

The importance of cattle to Fulani identity cannot be overstated. Even non-Fulani describe them in reference to their cows. "A Fulani's mind and his cow's minds are the same" or "The Fulani have more sympathy for their cows than they do for farmers". Riesman observes that among all of the aspects of Fulani society and ideology, one of the most important is the experience of going on transhumance with cattle. Despite, or maybe because of, all the difficulties involved (simply managing a herd of cows, exposure to the elements, sometimes living off of only milk and water for days, etc.), it is a revered way of life.

> The cattle embody the highest values in Fulani society. . . . For a Fulani man, the fact of submitting to the cattle, which are outside human society, liberates him from the influence of that society and at the same time makes people admit the incontestable value and legitimacy of this action. One of the kinds of men most admired among the Fulani is one who 'loves cattle' (Riesman 1974:159)

Another libratory aspect of life as a transhumant herder, is that one is freed from physical labor. There are many hardships in the transhumant life, but physical labor is not among them[12]. The idealized Fulani lifestyle is one in which they make a living by benefiting from natural processes of biological production without adding any physical labor. As one informant bluntly stated, "In the bush [on transhumance], you don't do any work. When the rains have come, the grass grows, that's all. If a pasture isn't good anymore, you go to another one".

Disinclination and ill-suitedness for physical labor are common themes in Fulani self-description. One informant, a transhumant Fulani who passed through Madiama during the cool

[12] This is an admittedly andocentric statement, but it is based on ethnographic data gained from men, and, in a dissertation that is focused on masculine spheres of production and knowledge, I hope this is forgivable. The degree to which women's work changes between village and bush life is not clear to me.

season after the harvest, came and sat with me in the brisk early morning hours as his herd grazed across the empty fields nearby[13]. We were watching the village rise and begin its work day, mostly women fetching water from the well near my house and pounding millet at the edge of town. With no prior discussion on the topic, he suddenly volunteered this observation:

> Marka sure do get up early to work. [*But don't Fulani and Marka have the same work to do, get water, get fuel wood, and pound millet?*] Fulani aren't the same. They're strength is not the same. If a Fulani woman got up early to get water for three days, that would end it. Our strength is not the same.

The disinclination to physical labor was also emphasized during interviews with Fulani about pasture management. In a focus group interview with Fulani herders at Konguena[14], I asked them what they could do to improve a pasture whose quality was diminishing. One informant responded to the question with an amused look on his face "Can pastures be improved through management? No idea. We don't know anything about that. We are not workers, we are herders". For the Fulani, pastures are spaces that have not been transformed by human labor, least of all their own. The investment of labor would defeat one of the main benefits of being a pastoralist in the first place, which appears to be the absence of the need to work.

In my ethnoecology interview, I asked respondents the same question about what can be done to improve a pasture whose quality is diminishing. The universal response was "transhume" (Fl. *uggudude*). Only one respondent out of 24 indicated that proactive management was even possible, saying "We could watch over the area, create rules of management of the pasture after consulting its neighbors, plant trees and sow grass seeds". Two respondents said pasture improvement was not possible due to the pastures' lack of owners. "In our zone, one cannot

[13] I suspect he came over mostly to have some of my hot coffee, which I was effectively obliged to offer according to rules of politeness and hospitality.

[14] Konguena is a pasture 15-20 km southeast of the village of Madiama, and well outside the Commune of Madiama. The herds belonging to many residents of the Commune of Madiama spend the rainy season in the upland pasture of Konguena. Many "residents" of Nerekoro can be found there during the rainy season, as well as the work cows belonging to the farmers of Madiama (herded by a hired Fulani).

[improve a pasture], because it is a common good". Although the pasture is named after a nearby Bobo village in whose domain the pasture is located, no efforts have been made to actively manage the space.

As a the two respondents above cited, there is no incentive to invest labor in a resource that does not belong to you. The social geography of the Konguena pasture is such that the temporary huts made of woven grass are fairly evenly distributed across the area, with each household forming its own isolated unit. There is nothing resembling a central village or social space and the pasture is open for anyone to use. Many Fulani from the Commune of Madiama pass the rainy season with their herds around the Konguena pasture, but there are herders from all over who spend at least part of the rainy season there. Not only is there no owner or manager of the pasture, there is not a sense of community among them as a whole.

> While many Fulani live in this area seasonally, there isn't really a community, as such. There are greetings of course, and maybe you attend a couple of baptisms. Mostly, everyone just takes care of their own business.

The strong civil society that is necessary to successfully manage a commons resource is lacking among the transhumant Fulani in the area, and not simply because they do not hold ownership or tenure over the pastures. The absence of cooperative social structures for proactively addressing public goods is supported by Riesman's ethnographic work as well, which portrays the Fulani as seeking individual gain through individualistic, if still social, means.

> Institutions which would permit people to multiply their returns by combining their efforts are foreign to the society. Cooperation for the common good hardly exists, as the common good itself does not exist, but reciprocal exchange of help is frequent. Indeed, insofar as leisure signifies authority, we discover that the Jelgobe, instead of competing in work, are competing in leisure (Riesman 1974:73).

Riesman goes on to observe that the Fulani live in a "leisure society", but where Western leisure society is based on consumption, Fulani leisure society is based on communication.

> Human energy not engaged in the production of goods for subsistence is used to maintain relations between people – not only to maintain them, but to maintain them in a particular form.

> The division of labor is also a division of leisure, and it is through an understanding of the leisure structure that we succeed in grasping most clearly one of the fundamental facts of Fulani social structure. For to be able bodied and not work means that there is someone who works for one, and that between oneself and that person there exists a relation of authority based on inequality of status (Riesman 1974:73).

Fulani leisure society is maintained through the same basic structures of social classes as described above for the Marka. There are nobles (*rimɓe*), people of caste, and descendents of slaves (*rimaiɓe*). In addition to the castes mentioned in the Marka section, there is also one cast that is unique to the Fulani milieu, that of the *jakoromé*. The primary occupation of *jakoromé* men is to act as commercial agents for Fulani men when buying and selling cattle. *Jakoromé* do not herd cattle themselves, as that is not their place in society, they simply act as intermediaries for the Fulani herders. When a herder wants to sell a cow, he does not want to deal with customers himself, as negotiations can be heated and lead to the expression of strong emotions and financial needs. Instead, the herder has a *jakoromé* conduct the deal for him. One *jakoromé* described their primary role in Fulani society this way:

> Even when *jakoromé* earn a lot of money, they don't herd cows. They will buy a car in order to sell it in Abidjan (Ivory Coast), they will become a big merchant, but they won't go out in the bush with cows. That isn't their work. If a *jakoromé* gets cows, it won't be more than 3 or 4 cows. When Fulani sell cows, they say the price to the *jakoromé*. Afterward, the *jakoromé* takes car of the rest. That is our *true* work.

Inasmuch as Fulani make their living from herding cows, the *jakoromé* hold a very key position in Fulani society and no small amount of power. If a Fulani were ever to cheat one *jakoromé*, word would spread throughout the *jakoromé* community and that Fulani would have a difficult time doing business anywhere. Still, the *jakoromé* as a social class, do not exist outside of the Fulani milieu, nor is there a Fulani milieu without *jakoromé*, at least according to my informants on the subject. Despite this symbiosis

> *Jakoromé* and Fulani make their livings together. There are no Fulani without *jakoromé*, there are no *jakoromé* without Fulani. But *jakoromé* haven't become Fulani. We will never become Fulani. We can't.

Still, although the *jakoromé* are not Fulani, their place in society is higher than the descendents of slaves, as distinguished by the nature of their work. However, when one falls on hard times, as with this informant, one stoops to doing work that is below one's station in order to make ends meet.

> I have become a Marka today. Look at me, I am emptying out a calabash (for drying). This is not my work. This is Markas' work. Or *rimaibe*. I am a *jakoromé*. This is not my work. *Jakoromé* don't do this. Fulani don't do this. But now, my husband is dead, I have no money, no income. I had to go to a *rimaibe* to look for the tools because I don't have them.

Unlike in Marka society, there is no chance for social mobility between classes in Fulani society. A Fulani may become more or less wealthy or influential, but if one is not born Fulani, there is no way to become Fulani. With a narrowly defined definition of belonging, anyone without a Fulani name will simply never be able to become a Fulani. Even if one were to speak Fulani and herd like a Fulani, there is a fundamental distinction maintained between the Fulani and other ethnic groups such that full integration of outsiders into the Fulani ethnicity as an equal and full member is not possible.

> Fulani and *rimaibe* don't marry, not very much. Fulani are better than *rimaibe*. Fulani don't like farming, they like herding cattle. *Rimaibe* don't like herding cattle, they like farming. Even if a *rimaibe* gets cattle, they will give them to a Fulani to herd. Everyone to their own work.

Fulani identity is far less permeable than Marka identity. Fulani identity is neither open to entry by the former slave classes nor voluntary entry by other ethnicities. In contrast to the Markas, no one can "become" Fulani. One may speak Fulani fluently, adopt Fulani social customs and lifestyle, but without Fulani heritage, indicated most importantly by family name, one can never successfully claim Fulani ethnic identity. For example, the village of Nouna is entirely Fulani, except for the village chief and his family, who are Bozo. As such, the village chief's family grow up in a largely Fulani milieu, learning to speak Fulani (in addition to Bozo and Bambara). One of the current chief's sons has taken up a Fulani lifestyle, becoming a successful herder, living just as Fulani do. But while discussing his son's adoption of

pastoralism, he said that his son would never be able to become Fulani without resorting to deception, nor would any non-Fulani.

> I have raised my own animals here during the years. My son had seen that and he was attracted to it, so that during the drought of 1975, he found the chance to go follow a herd of a friend. He already knew how to tie a calf, to milk a cow, everything. He had the habit of doing it and the chance. Now he herds around Bougouni (region of Sikasso, on Mali's southern border with Ivory Coast). . . . If my son had gone to a Fulani area, he could have become Fulani, if others didn't already know him. He speaks their language, if he took a Fulani wife, he would become Fulani. But if he'd say that he is named Kontao[15], it wouldn't work. Even if he acted like them and thought like them. Here, former slaves cannot become true Fulani because they are known.

There are no social mechanisms for incorporating outsiders into Fulani ethnicity. The result of this impermeability is essentially that, according to Fulani ideology, to be Fulani is to be a noble. In the Marka milieu, *woloso* are considered Marka, though they are lower class. There are no low class Fulani, be they slaves or people of caste, because those who serve the Fulani are beneath them, and do not ever become one of them. When asking a *rimaibe* his ethnicity, he cannot say he is Fulani, but can claim no other ethnicity. Consequently, *rimaibe* are defined only by their place in class relations with the Fulani. The *rimaibe's* lack of full citizenship in Fulani society was underscored by one informant who described how empty his village was one year during the rainy season.

> Back in the day, all this village was on transhumance during the rainy season. The young the old the children, the men, the women, everyone. I recall one year, there wasn't anyone here during the rainy season except two very, very old Fulani, a man and a woman who couldn't not even walk well. Besides them, the entire village was empty. [*Even the rimaibe*?]. Of course, our farmers were here. I'm talking about the *true* Fulani, the herders.

The above quote also illustrates how important herding is in defining the "true" Fulani, as well as the amount of consideration received by *rimaibe* as full members of society. The strict standards for inclusion as a Fulani and the lack of class immobility leads to the conclusion that, within Fulani ideology, Fulanis are all inherently of the noble class. The Fulani self-perception as inherently noble was brought home to me when I attended the regional meeting governing the

[15] Kontao is a family name that is easily recognizable as Bozo.

descent of the herds into the NRID. A researcher from IER who was acting as my host was introducing me to various strangers in Bambara, showing off that I speak Bambara. One Fulani man, a government functionary, retorted in French, “No, no, no. You have to leave the Bambara when you are in here[16]”. I replied in Fulfulde, simply saying “I speak a little Fulfulde”. He replied, with a big smile on his face, “Ah haaaaa. Now you have become a noble”. I recognize that the man responded this way in humor, but behind such humor, there nuggets of truth can be found.

Conclusions

The Marka and the Fulani of Madiama can both be described as agropastoralists, but the historical pathways by which they arrived at agropastoralism are vastly different. The cultural values associated with their ethnic identities, at least those linked to subsistence practices, are likewise different. The Marka practice of agropastoralism emphasizes extensive agriculture and a more intensive form of pastoralism. Land limitations are gradually causing Marka farmers to adopt more intensive agricultural techniques, such as manuring fields and cash cropping. Keeping small herds of small ruminants provides Marka agropastoralists with a modest amount of manure for their fields as well as a place to invest their excess capital gained through agriculture or commerce. The two primary identifiers of Markaness are the practice of Islam and agricultural livelihood. As an ethnic identity, Markaness is highly permeable and open to others “becoming Marka.” Not only have former slave classes adopted Marka as their ethnicity, some have even managed to become nobles.

The Fulani practice of agropastoralism is the inverse of Marka agropastoralism. They practice more extensive pastoral management and intensive agriculture. Their fields are small

[16] As the meeting is concerned with descent of the herds, it is an affair squarely in the Fulani milieu. Much of the public commentary was done in Fulfulde and there was a designated person to translate back and forth between French and Fulfulde.

and their production focuses on subsistence crops. Herding, especially cows, represents their means of making money and is preferred over farming. Fulani idealize the transhumant herding lifestyle and many Fulani agropastoralists claim that they would stop farming if they could only increase their herds enough to become fully transhumant. Fulani ethnic identity is very closed. The only way to claim Fulani identity is to be born into it. Despite the fact that they may have lost their previous ethnicities, former slave classes cannot ever claim to have become fully Fulani, because they do not come from Fulani lineages.

CHAPTER 8

DECENTRALIZATION AND FARMER-HERDER CONFLICT

Marka and Fulani constructions of identity are built upon subsistence niche, religion and language, all of which are embedded in dynamic historical processes of changing power relations. In recent decades, reduced rainfall and increased demographic pressure have put a strain on the land in West Africa and have precipitated increased competition and conflict over land-use. In and around the NRID, competition and conflict most often occur over the relative allocation of land for agriculture and pastoralism, the control over the timing of subsistence activities, and control over the coordination between farmers and herders. These issues are relevant in the Commune of Madiama. The perspectives of Marka and Fulani on the topic reveal different visions for the future of agropastoral development in the region.

Descent of the herds and regimes of management

The transhumance of Fulani pastoralists in and out of the Niger River Inland Delta has been going on for approximately 800 years. In response to the prolonged insecurity of living under pillage-prone foreign powers, the Fulani organized militarily and founded the Dina slightly less than 200 years ago. Spanning the southern NRID, the Dina precipitated the first centrally administered management of transhumance in and out of the delta. The Dina is virtually always the earliest historical reference point on the topic of the organization and coordination of rural production,[1] both in the literature and in my ethnographic data. In order to establish herders' land

[1] No one I talked to exhibited any knowledge of pre-Dina customs, other than general land-tenure customs, as were discussed in Chapter 5. The only remarkable quality mentioned about life prior to the Dina, was consistently that people weren't Muslim then. The Dina brought Islam to the many of the rural people of the area.

rights, the Dina established clearly delineated institutions of land tenure in the pastures of the inner delta, in which *jowros* were made responsible for managing the valued grassland floodplains.

The Dina designated a system of cattle trails leading in and out of the Delta. Unlike the bourgou pasture of the inner delta, the system of trails was never assigned ownership. As a land resource, the Dina apparently decided that these trails neither required nor merited such safeguards, as herders only use the trails for a few weeks each year. In that era, the uncultivated wilderness was much larger. It was unlikely that farmers would want to plant fields in areas that have tens of thousands of cattle streaming through them during the harvest season, especially when there were other options further away from the threat. This would have been especially true while living under a political regime that was controlled by Fulanis.

By establishing governance over land use, the Dina asserted power over the other user groups (farmers and fishermen) to control space. However, by definitively labeling spaces, and their ownership, this assertion of power also served to reduce conflicts that stem from uncertainty and competition over access to land. The success of this effort is illustrated by the durability of the institution of the *jowro*, which has survived successive political regimes to the present day, where the *jowros* are still powerful actors in the annual transhumance cycle. Despite being a long-established and culturally recognized position of power, the official role of the *jowros* in the governance of transhumance is debated by the current government of Mali. The role of the *jowros* is not much debated, however, among the herders themselves.

This entire system governing the transhumance was instituted and enforced by the Dina, which had a strong central government. However, even after the Dina fell to the Tukolor, who subsequently fell to the French, the institution of the *jowro* survived more or less in tact, as did

the customs that guided the annual descent of the herds. Communications and travel being as slow as they were, the central government of the Dina did not have direct say over local-level decisions regarding how the descent of the herds was to be managed, but it did set up a system in which authority over specific areas and local processes was clearly delineated. This authority was backed up by the threat of force, which was notoriously strict. By instituting governance structures over land use, the Dina represents the first coordinated effort to address farmer-herder competition for land, the basis of farmer-herder conflict today.

Local discourse on the history of farmer-herder relations is complex, and often incorporates the themes of political, technological and environmental change. The government's capacity to threaten serious punishment is frequently cited as a variable that has changed over the years and impacts decision-making. The following passage from an interview with a key informant reveals a great deal about historical and contemporary aspects of the annual transhumance under different political regimes.

> With the French, there were not a lot of conflicts, and if there were one, they would go to a judge and deal with it right away. They would have the village chief do an investigation to find the truth of the matter. It was the head of the canton[2] who was in charge, but he worked closely with the village chiefs. The head of the canton was also in charge of the descent of the animals. After independence, conflicts have become more numerous. Because of the departure of the predators, the herders don't really watch over their animals anymore. Also, the quantity of animals has become much greater. The peasants' fields as well. The plow contributed to this, as well as population growth.
>
> In the time of Modibo [Keita, first leader after independence, 1960-1968], it was based on the same rules as the French. At that time there was the Chefs d'Arrondissements. He would call a big meeting of village chiefs to fix a date. No one could descend before the date. If they came, they were sanctioned by the law. The sanctions were effective. No one ever really came before the date, very rarely. After Modibo Keita, it was General Moussa Traoré. The same system was in place: the Chef d'Arrondissement and village chiefs had a meeting to fix a date and it worked.
>
> One could say that everything has been ruined with decentralization. There is no respect for authority, or at least less respect for authority. Democracy is poorly understood. They think that everyone is free to do as they like. Under democracy, the rich own the truth. If a big herd wants to come before the date, the herder sells on single cow in order to pay his needs [informant gestures pulling money out of his pocket]. There are village chiefs, gendarmes, prefects, sub-

[2] The *Canton* is a former administrative unit under the French colonial government, roughly equivalent to the *Arrondissement*.

> prefects, mayors [repeats gesture for each position and then wipes his hands together]. There it is, its finished.[3]

One theme that runs through this passage is the efficacy of strong government in reducing conflicts and maintaining respect for coordinated management systems such as the descent of the herds. In discussing the issue with elderly men – men who were young adults under colonial rule and have personal memories that span the end of colonialism and the entire post-colonial era – the breakdown of the order that governs the transhumance is most often associated either with independence in 1960 or the transition to democracy in the early 1990s.

> Before independence, there weren't nearly so many fields, there weren't so many animals. There were fields here and there around villages, but most of the space was bush, even throughout Madiama, so there wasn't really that big of a problem then. The Fulani were installed in their own villages and they migrated with their animals from there. Now, they are diffused throughout every corner of the wilderness that isn't cultivated. This whole situation makes for greater opportunity for conflict.
>
> It used to be that around the end of September, animals would simply descend to the bourgou. These animals were better looking. This changed since the time of Moussa Traoré. Since Moussa, it is more organized by the state, with fixed dates, governmental meetings, mayors, etc.

Today, in addition to the *jowros*, there is an official governmental system through which the descent of the herds into the delta is managed. Official meetings are held at the communal, circle and regional levels to discuss the state of the upland pastures and watering holes, the health of the herds, the progress on the harvest in and around the delta, and other factors that inform the decision of where herds should be and when.

At the communal level, the meeting is called by the Mayor, who invites representatives from each village chief, farmer and pastoralist associations, as well as representatives for the non-local herders poised to pass through the commune. Madiama, being at the edge of the floodplain rather than in it, is not governed by the regional meetings that determine dates of

[3] Through the entire course of this interview, we watched as a constant stream of herds walked down the cattle trail toward the pastures at the edge of the Bani River. This was several days before the local meeting was held to discuss the entry of the herds into the commune, a full month off from the actual date of entry that was later set, and even more in advance of the dates that were eventually set for the entry into the Commune of Jenné, the herds' destination. The informant gesticulated toward the herders "Look! There are the rich men of Mali".

passage. As such, it holds the power to determine dates of entry into the commune. The meeting is notoriously contentious and has been known to last days without gaining a consensus. Prior to the formation of communes and the position of the mayors, a similar meeting was held by village chiefs, though it was not as open or participative.

Following the communal meeting, another meeting is held at the circle level. This meeting in called and convened by the Prefect of the circle and includes representatives from each communal government within the circle, as well as technical services and representatives from herders', farmers' and fishermen's associations. The topics of discussion are always the same: the state of the herds, the upland pastures and the harvest. At the conclusion of the meeting, dates for entry into certain key pastures and towns are set, but they are provisional and only serve as recommendations that will be taken to the regional meeting, where official dates are set.

The regional meeting is attended by representatives from each circle in the region, administrators from the regional and national government, representatives from technical services such as rural-extension and forestry services, and representatives from pastoralist, farmer and fisherman associations, among others. Every year, this meeting is held in November, the season when the rains have all but stopped and the upland millet harvest is underway. I was able to attend this meeting on November 19-20, 2004, and found it a simultaneously confusing and enlightening experience.

The meeting was opened with all the trappings of a major official event: banners, TV coverage, a panel of officials. There was an early discussion of the history and role of the *jowros* in regulating transhumance, followed by presentations by representatives from each circle about the state of the pastures and the harvest in their circles. The question of dates for the descent of

herds was not discussed until the second day. When it was discussed, it was debated in earnest, with several heated speeches about how the dates were too soon for the farmers' needs, too late for the herders' needs, etc.

Even prior to attending the meeting, I knew that herds had crossed the Bani River into the Commune of Jenné as early as October. I had personally watched several herds fording the river in early November, which was preceeded by one informant who publicly stated at Madiama's communal meeting on October 4th that there were already a lot of herds on the other side of the river. This whole scenario begs the question of official management processes, especially those at higher levels of government. During the course of the regional meeting, I asked a question to a random person behind me. "Is there anyone here at this meeting who doesn't already know that the herds have long since entered many of these sites?"

> (Laugh). No. Everyone knows that. The *jowros* have already had the animals come down. Its been a long time. There is so much profit for them and for the authorities also, with the dates very late. But it's the law that we officially set a date at the conference, so we've done it. The *jowros* already have too much power compared to the authorities.

I asked another participant at the meeting whether this organization of events was unusual or if this is how it always goes. He observed

> Its like that every year, lots of talk and heated disputes about the dates of entry and traversement. Yes, everyone knows that the animals have already crossed the river. The meeting is unfortunately held at the same time every year, regardless of the rainfall. They shouldn't fix the date for this meeting like that. It should be flexible. Nowadays, the meeting is to maintain the spirit of management by the state, even though everyone knows it isn't followed and that the animals are already there. We have to keep the spirit of management so that we can master the coordination little by little. It used to be, people respected the dates. If not, the government would put you in prison. The government was very strong then. Now, with a new democracy, the government is relatively weak. And the people don't understand democracy. They think they are free to do whatever, but the don't see their obligations and the government does not have a fist (power).

Both of these individuals indicate that despite all of the official governmental meetings regarding the descent of the herds, the government has little effect on the actual movement of animals. Instead, the historically powerful institution of the *jowros* continues to govern transhumance. The official meetings simply provide a veneer of governmental control. However,

the existing practice of holding late meetings to set official dates provides more than a discourse of management and control; it also carries significant financial benefits to many powerful actors. The recurrent theme of officials "benefiting" from the herders indicates that there is incentive for officials to maintain the status quo, even though it is dysfunctional from a governance point of view. It is widely expressed that political authorities have strong incentive for the official calendar to be unrealistic, running very late relative to the ecological variables that influence the descent of the herds. As one government official bluntly told me "Herders often give money to government officials to gain access to pastures prior to legal dates. If not, they would have to obey the laws". This seems so widely known and practiced, that it is now practically built-in to the system.

The custom of herders paying off officials is neither new nor secret. The mention of profits for the authorities is a reference to what might officially be called fines, but are commonly considered bribes. Bribes are a major part of the conversation when discussing descent of the herds and (lack of) respect for the calendar. Even during the rule of dictator Moussa Traoré (1968-1991), the Fulani regularly paid the state veterinarians, who checked on the herds' health in order to make recommendations to the state bureaucracy, so that they would advise early descent (Moseley 2001).

One local Fulani herder interweaves narratives of ecological change with historical and contemporary management annual transhumance. Like many Fulani herders, he is contemptuous, though not otherwise much concerned about, the government's attempt to control the entry into the delta.

> It used to be that descent wasn't a question of dates, but simply when the water went down enough to cross and to find somewhere to graze in the delta. Sometimes, even when the date was set, many herds didn't cross for fear of the river itself. [At the beginning of the rainy season] herds left the delta for the same reason: they had to because there was no where to stay. Even all the horses and donkeys in the delta went to the plateau for the rainy season. [In the delta during the

> rainy season] every time anyone went to shit, they had to take a canoe out to do it. Any good herder in the area knows the entire calendar of crossing after Jafarabé[4] is set. It is always the same since Sekou Amadou. It is still the *jowros* who control the descent, even today. The administration? Phbt. What do they do? They make a lot of noise and they hold their meetings every year, but it doesn't mean anything. Nothing. The *jowros* make everything happen, and without any meetings. Its all informal. Everyone knows that for each town, the herders of that town lead the movement of herds to their town, under the guidance of the *jowro*, if there is one, and the chief, if there isn't.

The systems of transhumance as it actually functions, represents an example of decentralization of power over natural resource management, albeit more plutocratic than democratic. The position of *jowro* is not elected, it is inherited, and although it is a position of locally-centralized power, there is no formal coordination between *jowros* nor do they have formal accountability to local people. Instead, *jowros* form a diffuse network of independent decision-makers. This form of decentralized power over natural resource management exists in spite of the governments efforts to keep a hand in the process. The reality as portrayed by herders and government officials alike, is that the Fulani, in general, and more specifically the *jowros*, make the decisions of when herds enter the floodplains, regardless of what central authorities say. In areas where there are no *jowros*, herds may enter an area with (bought) consent of local authorities, despite the protestations of the population. Alternatively, herders might arrive in an area despite the objections of both the local authorities and the population.

During the 2004 harvest/descent-of-herds season, events in the Commune of Madiama illustrated several of the issues and the difficulties of managing the commune in accordance with the *approche terroir*. The Commune is located in an awkward position in the process of the descent of the herds. It is outside the floodplain, and so is not governed by *jowros* nor the meetings at the circle and regional level (for whatever they are worth). However, the Commune of Madiama is bisected by a trail that serves as a major point of entry into the floodplains around

[4] Jafarabé is atown at the southwestern edge of the delta that is the site of the largest Fulani festival of the year, celebrating the return of the herds into the delta as the annual floodwaters descend. It is frequently used as a basic reference point for the entire process of descent of the herds in the delta.

Jenné. The *approche terroir* dictates that communes manage their land as they see fit. Although the *approche terroir* implicitly recognizes the power of individual villages over their territories, only communes are officially recognized in the decentraliztion legislation. The cattle trails, however, are by some reckonings, a federally-recognized space for pastoralists, albeit one that leads to and through spaces governed by villages and communes. Unclear tenure, general disrespect for the government, and weak capacity for enforcement, have led to contestations of power over the cattle trails.

The amount of rainfall during the 2004 season had been more or less adequate for rain fed crops, approaching the average of around 600 mm, but the flood in the *casier* west of the Commune of Madiama was very weak. While the upland crops had grown well, the rice crop was never even planted due to inadequate flooding. However, temporal distribution of the rains was poor because they stopped early and abruptly around the end of September. This meant that the crops had grown well, but there was a lack of water during the crucial season when the grains fill out and ripen. The early and abrupt end of the rains also meant that grasses and watering holes in the upland pastures began to dry out early, putting pressure on the herds to descend into the floodplain early.

The Commune of Madiama held its meeting for entry of the herds into the commune on November 8, considered very late by many herders. The date set for entry into the commune was November 22. Even at the meeting, participants observed that many herds had already crossed the river and entered the floodplains, though they done so through other communes. All of this was occurring over a month prior to the regional meeting that officially sets the dates, emphasizing the degree of disconnect between official processes of governance and actual patterns of resource use.

Custom dictates that entry of herds into the territory of a village should be led by the herders of that village. Nouna, being the proprietor of the pasture at the end of the trail through the Commune of Madiama, has traditionally taken that role. More recently, respect for that custom has broken down, particularly among herders who are not from the area. On the 12th of November, several herds attempted to enter the plain belonging to Nouna, next to the fields owned by the village of Nouna and cultivated by people of numerous nearby villages, both in and out of the Commune of Madiama.

> We had turned herds back to Promani[5] this year, but 2 days later they passed in the middle of the night. We made them turn back by swinging our clubs. . . . Since a long time ago, no one comes down before the herders from here, Nouna. Now, if you have a field next to the plain, you have to sleep there to guard it.

The "we" he refers to is made up of villagers from Nouna, who are virtually all Fulani, just like the non-local herders who were being turned away. This highlights that there are differences in attitudes between local and non-local Fulani[6] when it comes to managing land resources. As discussed in the previous chapter, Fulani social organization does not traditionally promote group coordination or collective action. Instead, it is based more on the pursuit of individual interests. Most people state that conflicts between people of the same ethnicity are generally less severe and more likely to be worked out amicably, but that did not stop my informant from the herders' association from worrying about being beaten by the Fulani herders who had installed themselves in the local pasture. I have made the case in Chapter 7 that ethnic ideologies need to be considered when forging development interventions. The divide between local and non-local Fulani perspectives on land-use illustrates the need for balance between ethnic ideologies and material subsistence practices in natural resource decision-making.

[5] The previous village passed on the trail during the descent.

[6] Unfortunately, I was unable to interview the non-local herders involved in this scenario. All of my possible translators, and I would have almost certainly needed a translator, were people somehow vested in the Madiama power structure and/or the dispute, meaning any data gathered from the herders would have been colored by their likely reticence to speak openly, if they would have agreed to talk to me at all.

Having failed in their initial attempt to enter the plain, the non-local Fulani opted for a nocturnal entry on the 14th of November. On the 15th, I attended a meeting of the local Herders' Association in which they discussed their options of responses to the state of affairs. The meeting was conducted completely in Fulfulde, so I relied on a key informant, a member of the association, to summarize the discussion and its conclusions in French.

> They Mayor came by this morning to say that a herd of cows has entered the plain passing by Promani and Nouna, though the herders are not from this commune. They've gone all the way to the river. The mayor has informed the Gendarmes in Jenné and came to verify that they hadn't yet crossed the river. They passed by at night, so no one saw them while they were going by. Now the mayor is trying to make them leave the commune [towards the highlands again]. If they cannot, we of the three villages [in the Commune], Nerekoro, Promani and Nouna, will bring our herds down. There is neither water nor grass in the highlands, so our animals suffer. If [the strangers'] herds don't leave here, it will ruin our grass. So, if they won't leave, we need to come down in order to profit from our own pasture. If we can get the herds to leave, our animals will stay in the highlands for a while longer.
>
> If we had been aware when they were passing, we would have stopped them and made them turn around, but as they are numerous, more than eight herds, and they are already at the river, it will be difficult to move them back all the way to the other side of the highway again. At the circle level, they will fine the herders, who come from Taga and Sofara[7], not far from here. We could try to talk to them as fellow herders, but they wouldn't listen and maybe they would get angry and beat us. It isn't worth it. Its better that the authorities sanction them.
>
> Some in this meeting said it isn't worth it to inform the mayor and await his resolution. He's known since yesterday and hasn't done anything. [Many members of the association] want to just to bring our animals down. Me, I wanted to alert the mayor [about them]. Those herders are not sensibilized. They are like animals. The follow only their minds. They don't consider how their behavior hurts others. The pasture and the trail is property of here, the village of Nouna.
>
> If the herds already here cannot be made to leave, the mayor will not be satisfied, but will have to agree to let our animals come down. If you are in your own place and strangers have come, and we have informed him, and he hasn't done anything, he will be obligated to agree to permit us to come to our place as well. We won't wait more than a few more days before bringing our animals down.

Three days later, the problem had resolved itself, though not necessarily to the satisfaction of all parties involved. The villagers from Nouna did not gain any satisfaction in terms of turning non-local herds out of the pasture. Instead, other local herds were brought down to profit from the pasture as possible. Oddly enough, Nouna was the last to come, out of concern for their as yet unharvested crops. Meeting with the Mayor of the Commune of Madiama on November 18th, I was able to discuss the official response to the problem.

[7] Both villages are in the commune north of Madiama.

> The prefect (administrator of the circle, based in Jenné) has been informed that [the herds] are there, but as there is no rice in the *casier* this year due to lack of flooding, it is not worth it to make them leave, so nothing is being done to the herds already there. The animals from Nerekoro came through 2 days ago and most from Promani came yesterday. Nouna has not come yet, but will soon. Nerekoro and Promani have gone all the way to the plain, but as Nouna hasn't even started the harvest yet, they don't want [their herds] to be too close to the village. The trail and the plain are not yet open for everyone. We haven't officially given the date yet. The herds who are there don't pose a problem, but if we opened officially, everyone from Taga and Sofara and Konio would come, and there is no space. I don't know if it is even worth calling the [regional] meeting this year for the descent of the herds, as there are already many herds in the plain. We'll see.

Both of the above local actors, the mayor and the member of the herders' association, construe the cattle trail and the small pasture between Nouna and the river as local resources to be managed for local exploitation. Their lack of power to stop other herders from utilizing those resources for their own benefit shows the challenge of applying the *approche terroir* to a space that is important in the regional human ecology. The mayor, the chief of Nouna, and the herders' association have incentive to manage the trail and the pasture as primarily local resources, but extra-local actors can also force their claims to those resources when local management is not to their liking. Local attempts to set dates for entry into the commune have recently become more open and inclusive, but without means of enforcing their conclusions, they remain a veneer of management over a system in which more powerful actors can do as they please, so long as "fines" are paid to higher authorities.

Farmers' and herders' perspectives on causes of conflict

At the outset of decentralization in Mali, several authors predicted that while the *approche terroir* may work well in agrarian communities, it would pose serious problems when articulating with pastoral livelihoods that operate across a much broader spatial scale. Painter et al (1994), were among the first to emphasize that the very concept of the *terroir,* which has a long history in French geography and forms the foundation for the *approche terroir,* has always been a reference to sedentary agricultural communities, and was never intended to address

mobile pastoralist communities and their production needs. The progressive adoption of the *approche terroir* by NGOs, governments and the international donor community (United Nations, World Bank, International Monetary Fund, etc.) has been directly linked devolution of natural resource management from the central government to the local level.

There are several different aspects of Sahelian livelihoods that are not based on village territories, but are geographically and temporally dynamic and are closely linked with factors outside of ones' village territory. Pastoralism is one of the largest such sectors, followed by fishing, commerce, and wage labor. As Painter et al. point out, the *approche terroir* "basically implies further, or intensified, investment (primarily of local labor) in land-based agricultural and natural resource activities" (1994:457). This intensification of locally-based production contradicts historical trends in the Sahel for agrarian household economies to diversify, usually into livestock production, which is seen as more remunerative but also more spatially extensive.

While farmer-herder conflicts in general are age old, most residents of Madiama agreed that farmer herder-conflicts have only recently become acute. Some attribute this to environmental change compounded by political changes, wherein there is less coordination between herders and farmers by strong authorities.

> Before independence, there weren't nearly so many fields, there weren't so many animals. There were fields here and there around villages, but most of the space was bush, even through Madiama, so there wasn't really that big of a problem then. The Fulani were installed in their own villages and they migrated with their animals from there. Now, they are diffused throughout every corner of the bush that isn't cultivated. This whole situation makes for greater opportunity for conflict.

Farmer-herder relations are shaped by the timing and geography of their production calendars. Planting of upland crops coincides with the beginning of the annual rains in June and July. During this season, the river starts to rise and the cattle herds must vacate the floodplains. There is a moderate risk of farmer-herder conflict at this time because herds may graze or

trample fields of newly sprouting millet and sorghum as they pass by on their way to upland pastures. Fields damaged in this way are often able to be replanted, making the costs of the damage relatively low.

The season of serious conflicts comes in November and December. Substantial rains usually end in October, causing the upland water points to go dry, and causing upland pastures to dessicate. This drying pushes the herds down toward the river floodplains. At the same time as herds are descending, the harvest is starting: first the rain-fed crops around the floodplains, followed by rice crops in the floodplains. Field damage sustained in the harvest season cannot be compensated for, other than with money to buy replacement grain. Consequently, tensions run high during this season. As one local Fulani put it,

> During the dry season, we are same-mother, same father[8], but while there are crops in the fields, we don't know each other. . . . It is the years of good rainfall that are the years of bad conflicts. When the millet fields are good and the plain is full of rice fields, there is nowhere for herders to go. That makes for greater pressure, because all of the herds are coming down from the plateau, but there is no space for them.

During this season, farmers risk ruin if a single herd of cows enters an unharvested field, even for a short time. Pastoralists risk a decline in their herds' health if they do not obtain adequate water and pasture for sustained lengths of time (Moseley 2001). The root cause of these conflicts is competition over scarce land resources. In order to gather local perspectives on farmer-herder conflicts and competition over land, I included two questions at the end of my ethnoecological survey on the topic. First, I asked informants to cite the causes, both immediate and ultimate, of conflicts. Following this question, respondents were asked for their ideas on what could be done in order to reduce farmer-herder conflicts[9].

[8] "From the same father and same mother" is a common expression indicating intimacy and amity, as shared between two brothers.

[9] There are two important caveats that I should mention following this discussion about Marka and Fulani perspectives on conflict. First, all of the Fulani included in my survey are based in Madiama and moreover, were actually found there while the survey was being conducted. My sample did not include fully transhumant Fulani

Marka and Fulani perspectives on the causes of conflict are remarkably similar, though each group sees the problem through its own lens. Among all the Marka responses, the theme that was most common was that of "entry into unharvested fields by the herds". Twenty-six out of thirty-eight (68%) responses included this as a key element that causes conflicts. As one respondent put it, "If the animals didn't leave their path in order to enter the fields, I don't know what herders and farmers would fight about". The only surprising aspect of this is that the percentage of respondents who mention it is not higher.

The most common response among Fulani informants (46%) was that conflicts are caused by the fact that fields have occupied all the pasture lands.

> The cause of conflicts between the Fulani and the farmers in our commune is that the pastures are occupied by fields. The cattle trails and the banks of water points, such as streams and ponds, are occupied by fields as well.

> The causes of conflict between herders and farmers is the occupation of spaces by the farmers: the cattle trails, the banks of the water points. So there are no pastures for the cattle to the point that the animals damage fields in passing.

The Marka and Fulani characterization of the causes of conflicts may appear to be different at first glance, but further consideration reveals that they are actually describing the same phenomenon from a different angle. They both set themselves up as the victim of the other, who is portrayed as being the perpetrator of an offense, if an understandable one. Within both sets of responses, there is a recognition that the expansion of cultivated spaces correlates with the reduction of pasture spaces, bringing farmers and herders into closer contact with one another.

---

who were not from the area. Second, my participating sample of locally-based Fulani was skewed toward those who were less mobile. Recall that I only attained 24 respondents out of a sample list of 40 households. Many of the non-participating households were not attained because they themselves were on transhumance and were further in the delta. As such, both my sample frame and my real sample could be said to be skewed toward more sedentary Fulani households. It is reasonable to conjecture that a sample that included more transhumant Fulani households would have found even greater emphasis securing pasture resources from encroachment by fields. I would also speculate that more mobile herders, those who spend more time on transhumance, might have had a less conciliatory attitude toward farmers when it comes to competition over land-use.

The Fulani say fields occupy pasture, water points and cattle trail, Marka say herds invade unharvested fields. Ethnographic observations support both of these claims as true.

Farmers and herders share the fundamental narrative of "We are just trying to make a living, and the other comes along and damages or destroys our productive resources". However, within this theme, Fulani tend to emphasize more heavily that water points such as ponds and streams are increasingly cultivated or circumscribed by fields, making it difficult to water cattle even where there is adequate pasture. In the arid environment of the Sahel, any area were there is standing or flowing water is a resource that will attract both farmers and herders.

> The cause of conflicts between the Fulani and the farmers in our commune is that the pastures are occupied by fields and the cattle trails and the banks of water points, such as streams and ponds, are occupied by fields as well.

Although the transformation of bush to fields is widely acknowledged among the Marka, none mention the cultivation around water points as a particular problem, and the overall lack of water, i.e. rainfall, is rarely cited as an ultimate cause of the problems between farmers and herders. The increased cultivation around water points signals that the scarcity of rain is increasing the value of water points (standing or flowing) as agricultural resources. It also reveals their power to claim that resource despite its negative impact on the herders.

The second most common theme in both the Marka and Fulani responses, was the role of individual behaviors and attitudes that exacerbate conflicts. Among the Marka, 37% of the respondents cited herders practice of intentionally driving their herds into fields, or general Fulani "arrogance" as a cause for farmer-herder conflicts.

> The arrogance of the Fulani [causes conflicts].
>
> The herders are stubborn and betray the trust of the farmers.
>
> The arrogance of the herders [causes conflicts], in that they don't consider the recommendations of the farmers.
>
> Herders' heads are hard.

> Lack of consideration of farmers by the herders. They only see their interests, even though they feed themselves with agricultural crops.
>
> Everyone who herds animals, they look only at how their animal can be satisfied no matter what they find to eat.
>
> It is beneficial to the Fulani to enter fields with crops in the pursuit of their own interests.

Likewise, Fulanis frequently characterize individual behaviors and attitudes as being important in farmer-herder conflicts, typically casting this in terms of both parties being willing to see only their own side of the matter. Where Marka respondents leveled nearly all of their critiques at the other group, several Fulani respondents were more equally critical of farmers' and herders' practices.

> Everyone sees only their own interests.
>
> Conflict happen because no one is patient. Everyone has a big heart, always read to defend his goods.
>
> The herders don't like the farmers and vice versa.
>
> Certain herders don't pay attention to fields, they only see their animals.
>
> All that I know is that the wandering of animals makes them enter in the fields and ruin them, or the herders themselves drive their animals to the fields intentionally. That brings conflicts.
>
> Lack of respect of the calendar for the passage of animals by the herders because of lack of water on the plateau.
>
> [Conflicts are caused by] the wandering of animals and lack of watching over of fields by their owners. The animals are generally herded by children.

Only one Marka respondent cited farmers' individual behavior as a part of the cause of conflicts by saying farmers may "fight the cattle with no real reason", acknowledging that some farmers reflexively fight herders even when no offense has occurred. The practices of herders intentionally driving their cattle into farmers' fields and farmers reflexively fighting against or taking advantage of herders are were corroborated in my other interviews with key informants, including some Fulani.

> When the cows are full, that's what the Fulani like. They would let their herds into your fields. Some Fulani will wake up their cows at night to go to a field. Its only people from Nerekoro who

> do that here. Strangers (transhumants) don't do it because they are afraid of the law and the gendarmes. The problem is that adolescents are the ones who actually herd the cows and adolescents don't respect people. I have spoken with the chief of Nerekoro every year regarding this problem. He says he talks to the herders, but they don't listen. Some adults do it too, but it is mostly adolescents.
>
> Today, we give the animals to children who aren't capable of really watching over them. Before it was young men between 20 and 30 who looked after the animals. The Fulani have become lazy, but also, before, there were lions and panthers. If children were left to guard the herds, [predators] would take animals because children can't fight them off. There were also hyenas too. Now that there aren't any such wild animals, the Fulani leave the herds with children. Now its around the 10-14 year olds who look after the animals.
>
> There are several ways that damage can be done. First, a youth may be proud to be the first to enter the plain or even to enter a field. Second, the herder just falls asleep and the herd wanders toward a field. Third, there are simply not enough herders for a herd that is too big . . . . But really, field damage is practically our custom here.

Similarly, one Marka farmer mentioned that some farmers will exaggerate field damage and crop loss. "If cows do 1000 CFA damage, the farmer can say it was 20,000". I asked if some farmers ever actively try to sustain damage for this sort of gain, and he replied "No no no no no. There is too much risk [of not getting compensated at all]." But they will, however, do it opportunistically. He is personally opposed to both of the above practices because they are simply dishonest. "People who would do that are not afraid of God".

Marka and Fulani responses to the question of the causes of conflicts reveal a shared opinion. Both see the link between increased conversion of bush land to fields and the exacerbation of conflicts. Within this topic, Fulani focus more heavily on water resources than do the Marka, but ultimately both see the expansion of cultivated areas as a primary cause. The difference between them is that the farmers see opening fields as their right, whereas the herders see the opening of fields as an assault on their rights. Fulani and Marka both see individual behaviors as another key aspect of conflict. The disinclination to consider the needs of the other could be construed as a perceived lack of shared interests, meaning that there is lower incentive to concern oneself with how personal behavior will affect the other.

Farmers' and herders' perspectives on conflict reduction

Following the question about causes of conflicts between farmers and herders, the survey asked respondents to share their opinions about what steps could be taken to reduce conflicts between farmers and herders. Where responses to the question of causes are fundamentally similar, Marka and Fulani respondents give notably different answers regarding how to reduce conflicts between them.

The most frequent theme that appears in Marka responses is that of increasing mutual understanding between farmers and herders, a topic mentioned by 39% of the respondents. This topic usually takes the form of establishing official rules and agreements about the entry of herds into the commune. Such a system is already in place and meetings, which used to be called by village chiefs, are now convened annually by the mayor of the commune. The timing and results of these meetings are often unsatisfactory to the herders, who claim that the meetings are consistently held too late in the season. Even though it should be implied, numerous Marka follow up by saying that the rules should then be followed and respected, pointing to the common occurrence of creating rules only to have them ignored.

> Cattle owners and farmers should come to understand each other.
>
> People should understand each other, farmers and herders.
>
> [In order to reduce conflicts,] establish rules and follow them.
>
> Respecting the conventions established between herders and farmers [would reduce conflicts].
>
> [In order to reduce conflicts,] have a meeting and establish rules and follow them well.
>
> Herders and farmers should consult each other and discuss things together in order to put management committees into place.
>
> [In order to reduce conflicts,] have meetings between herders and farmers to discuss and find a harmonious solution.
>
> [Conflicts could be reduced] if the herders and farmers worked together and established conventions for the management of the passage of animals.

The establishment of formal agreements between farmers and herders is a form of collective action that requires mediation by organizational structures, in this case governmental structures. Closely related to this point, the next most common theme in the Markas' discussion of conflict reduction is the role of the village chiefs. Twenty-nine percent of the Marka respondents emphasized the importance of village chiefs as mediators of formal agreements between farmers and herders. While this percentage is not very high, it is the third most frequent theme in their responses. More importantly, this figure is telling when it is contrasted against respondents' opinions about the role of the mayor and of higher administrative authorities.

Only three Marka respondents (8%) explicitly indicated that the mayor should have an important role in forging agreements between farmers and herders, this despite the fact that the mayor's office is now in charge of the annual meeting that sets the dates for the herds' entry into the commune. There are a couple of ways of interpreting this datum. First, until the establishment of communes and mayor's offices in 2000, the village chiefdoms were the primary institutions of local authority. Prior to the establishment of communes, the villages chief of Madiama had customarily convened a meeting of area village chiefs and representatives of the herders regarding the entry of animals into the village territories. My respondents were overwhelmingly older men (35+) and so have the importance of village chiefs engrained in them, whereas the mayorship is a new position. The omission of the mayor from the discussion of conflict reduction strategies may be the result of continued recognition of the significance of village chiefs' power to govern social relations, such as agreements between farmers and herders. This could be the result of simple inertia or it could indicate a skepticism toward the new institution of mayoral power.

Alternatively, my ethnographic data indicate that the mayor's office is often confounded with the family of the village chief of Madiama. Since its inception in 2000, the communal council has been dominated by members the family of the village chief of Madiama, including the mayor himself. The tendency to confound the two is particularly high among inhabitants of the village of Madiama, who comprised a full 66% of my stratified random sample of the Marka population in three villages. As such, many respondents may have automatically assumed that reference to the villages chief is, for all practical purposes, a reference to the mayor's office. It is not clear to me which of the above is the best interpretation.

Although there are few mentions of mayoral participation in conflict reduction among Marka respondents, all mentions are favorable. Opinions of the administrative authorities, appointees of the central government at the arrondissement, circle, and regional levels, are generally much more negative. Only 13% of Marka respondents cited the involvement of administrative authorities as a positive aspect of conflict reduction and resolution.

> Everyone has to be involved in the passage of animals through the commune: the farmers, the herders, the village chiefs, the village counselors, administrative authorities. We have to ask the authorities to be just in the resolution of conflicts.
>
> It must involve the mayor, the village chief and the authorities in Sofara and Jenné [Sub-prefect and Prefect respectively].
>
> There needs to be justice by the administrative authorities.
>
> The herders and farmers and administrative authorities should work together. There needs to be a sensibilization of all the people who use resources in the commune.
>
> The administration must be just between them and judge things such as they must. They should make sanctions against herders. It must involve the mayor, the village chief and the authorities in Sofara and Jenné.

I categorize these responses as calling for continued or increased involvement of administrative authorities. While I believe this label is accurate, there is also a backhanded critique embedded within three of these responses. The emphasis on the need for justice from administrative authorities implies that this is not necessarily the case at present. Extending that

critique, 21% of Marka respondents openly stated that the same administrative authorities should stay out of farmer-herder conflicts entirely.

> Leave the problems with cattle to the village chiefs and the villagers. Administrative authorities should not be involved. When there has been damage (to a field), administrative authorities should speak the truth. They should not profit from [herders'] money.
>
> Administrative authorities should fulfill their roles, the village chief and villagers' roles should become bigger in the management of cattle problems. Higher administrative authorities should speak the truth to the herders.
>
> Cattle problems should be dealt with by the village chiefs and the counselors. Administrative authorities should stay out of it. If there has been damage (to a field) they should fill their role honestly.
>
> The passage of the cattle should be left to the villages. Administrative authorities should stay out of it.
>
> Authorities profit from herders money, they cannot speak the truth, unless these authorities stay out of issues with the cattle, and leave it between the villages and the herders.
>
> Administrative authorities should stay out of problems with cattle and leave it to villages.

These passages illustrate farmers' perceptions that governmental authorities generally side with herders when it comes to farmer-herder disputes. Again, the trend in these data is supported by my other ethnographic data. The allusion to administrator "profiting" from herders money is a resonant image, and not just among farmers. I found that the phenomenon of herders paying officials at several levels is widely acknowledged as a part of how transhumance works. Farmers, herders, Malian development professionals, and even government administrators themselves readily discussed the fact that money frequently flows from herders to government officials during the transhumance in order to smooth out conflicts.

I hesitate to label this exchange because, according to people's descriptions, it blurs the boundaries between a fine, a bribe, and extortion. While discussing the topic, many Malians avoid a label altogether, preferring to use the gesture of removing money from a pocket rather than describe it verbally. Regardless of the label, herders, especially the ones with particularly large herds, it is simply a foreseeable, if negotiable and sometimes avoidable, business expense.

Whatever one chooses to call it, farmers feel that when administrative officials are involved, farmers are consistently on the losing end of conflict resolution and herders get their way, albeit at a cost. Consequently, they feel they have a greater access to justice, or at least power, when their local officials, such as the village chiefs and mayors, are in charge of resolving conflicts and managing situations that lead to conflicts.

Despite sharing many perspectives on the causes of conflicts, Fulani respondents approach conflict reduction from a very different point of view than Marka respondents. The most frequently occurring theme (46%) in their responses was that if individuals would take greater responsibility to watch over their fields or their herds, there would be less friction between farmers and herders.

> To avoid conflicts, the farmers have to pay attention to their fields, the herders their herds. Like that, if everyone guards their property, they would never beat each other.
>
> The only solution to avoid conflicts between herders and farmers, it is that everyone looks after their own property night and day.
>
> The situation that we live in requires us, everyone, to watch closely over our goods: the farmer his fields during the day, the Fulani his herd at night. Like that, they would not confront each other.
>
> I propose that the farmers watch over their fields and that herders watch over the animals. In this case, no one comes in contact with the other because the animals are animals, they don't choose.
>
> The Fulani need to watch closely over their animals and the farmers their fields.
>
> The farmers should watch over their fields, the Fulani should watch over their animals and keep them from wandering. In a word, everyone should pay attention to their property, the Fulani their animals and the farmers their fields. In this case, there wouldn't be any conflicts.
>
> Everyone needs to watch closely over their livelihoods so there will not be any confrontations.

The Fulanis' emphasis on individual responsibility stands in marked contrast to Marka focus on collective agreements. This is not to suggest that Marka did not at all mention the usefulness of watching over fields and herds more carefully, but that it took a much less important place in their array of responses. Only 18% of Marka respondents cited this as an aspect of conflict reduction strategies.

The infrequency of Fulani's mention of authority figures in the reduction and resolution of conflicts corroborates their emphasis on individual responsibility. Again in contrast to the Marka, the Fulani rarely mention the role of authority figures in conflict reduction. 17% of the respondents suggest that administrative authorities (*above* mayoral level) have a role in conflict reduction and resolution. All of those who mention the involvement of administrative authorities do so in a positive light.

> The administration should anticipate events and conduct dialogues in time, verify the presence or not of water on the plateau and fix the dates of passage of animals with the Fulani, the farmers and the Mayor.
>
> Farmers and herders should respect each other and talk to each other because the animals belong to both of them. To do this, it is necessary that the administrative authorities must involve themselves in order to open the trails that are planted over by fields.
>
> Everyone should be clear and everyone should respect the dates. The administrators and village chiefs should involve themselves and warn the herders not to descend before the date and for the farmers to harvest before the date. If everyone respects it, there would not be any conflict.

Moreover, out of 24 respondents, there is only one that specifically mentions village chiefs and one that mentions the mayor as important actors in conflict reduction. It should be pointed out that 33% of respondents discuss the need for dialogue between farmers and herders, but most do not specify who should convene and moderate this dialogue. Whereas the Marka had mixed, though mostly negative, attitudes toward the role of administrative authorities, the Fulani who mentioned them have a uniformly positive attitude toward the authorities' participation. There was never any suggestion that authorities should stay out of the issue.

Differences between Marka and Fulani responses suggest that they have very different relationships with political authority. Decentralization policies reinforce local power, bolstering the position of sedentary farmers to control land use, as was predicted by Painter et al (1994). Within the Commune of Madiama, there is only one village chief who is Fulani.. There are two Fulani on the Communal Council, but the majority of members are Marka. Consequently,

appeals to local authorities, who are more accountable to local populations, are perceived as likely to work in the favor of farmers. Conversely, appeals to higher authorities, who are appointed by the federal government and have less accountability to local populations, are seen as likely to work in herders' favor. The annual communal meeting on the descent of the herds has become a regular venue for debate on these questions. In Madiama, many key actors, both Fulani and Marka, attempt to bridge differences in perspective by stressing that most Fulani are also farmers and most Marka are also cattle owners, so they have shared interests. However, they still find it difficult to agree on how to proceed with the coordination of the harvest and the entry of the herds.

The second most frequent theme among Fulanis' responses was removal of fields from the cattle trail (42%), followed by the closely related themes of keeping fields away from blocking access to water points (33%), and a general separation of farmers' and herder' action spaces (33%). When combined, these three themes point toward the desire for stronger and clearer tenure over pastoral resources.

> As a solution, I propose that we leave the pastures for the animals, that we leave the cattle paths so that the herders and the farmers don't confront each other.
>
> I propose that the animals pasture on one side and the fields should be on the other side. Like that, no one comes in contact with the other and there wouldn't be any conflicts between them.
>
> The fields should be on one side and the pasture should be on the other. In this case, there would not be conflicts. In a word, the pastures should be left for the animals.
>
> The best solution is to separate pastures and fields. We can do fallows in the form of rotation to leave the pasture to the animals. Like that, herders and farmers won't confront each other.
>
> I propose that the farmers watch over their fields and that herders watch over the animals. In this case, no one comes in contact with the other because the animals are animals, they don't choose.
>
> We should leave the trail for the passage of animals only. The farmers should leave spaces and pasture for the animals.

The responses above illustrate herders' apprehensions about their lack of tenure over pasture spaces under the *approche terroir* and decentralization. As was predicted in the

literature, decentralization marginalizes transhumant pastoral production strategies because they require a large action space over which herders do not have any legal or even customary rights of control. This division between agricultural and pastoral spaces sought by Fulani respondents can be seen as a call for clearer and stronger tenure over pastoral zones. In effect, pastoralists call for the enclosure of their commons in order to protect it from agricultural encroachment, which is sanctioned under current tenurial arrangements.

Conclusions

Competition over increasingly scarce land is not likely to let up anytime soon in central Mali. Even though decentralization has only been underway for a short amount of time in Mali, rural producers' perspectives on how to reduce competition over land reflect their positions relative to the new distribution of power. The farming-identified Marka of Madiama consistently favor continued localization of power over natural resource management, as most local authorities, such as the mayor, the communal council and village chiefs, are also farming-identified Marka. Believing that local authorities will not act to defend the pastoralists' interests, the herding-identified Fulani, tend to favor greater interventions by administrative authorities higher placed in the government.

CHAPTER 9

DISCUSSION AND CONCLUSIONS

Ethnopedology, cognized models and land management

The sub-discipline of ethnopedology has called for research that moves beyond simple soil typologies to understand soil management practices in their historical and political contexts. The Commune of Madiama provided a unique opportunity for an interethnic comparison of ethnopedological systems, starting with soil typologies and then moving out into broader historical and political contexts.

Marka and Fulani in the Commune of Madiama both practice agropastoralism, but they practice agropastoralism differently, from both behavioral and ideological points of view. The convergence of Marka and Fulani subsistence behaviors into agropastoralism is relatively recent, and several aspects of their ethnic identities are closely linked with their historically distinct subsistence strategies. These ideological aspects of ethnic identity continue to guide natural resource management decision-making, sometimes even when their actual practices have changed. The Marka and Fulani subsistence behaviors and ideological constructs relating to subsistence reveal different values, motivations, and visions for the future of rural development in the region.

Contemporary Marka and Fulani natural resource management practices in the Commune of Madiama are shaped by ethnoecological systems, historical power relations, land-tenure practices, and ideologies of ethnic identity. Using a situated knowledge framework (Nazarea

1995; 1999), which is based on Rappaport's (1979) notion of cognized models (see Chapter 1 for elaboration), this dissertation has compared Marka and Fulani knowledge systems. Spanning from technical knowledge of soils, to knowledge of ecological functions, to subsistence practices, and to ethnic identity, Marka and Fulani cognized models of the environment and their places within it are widely divergent. Despite the fact that both Marka and Fulani are presently agropastoralists, they maintain distinct technical knowledge systems pertaining to land-management. Moreover they do not assign the same meanings and values to farming and herding. Marka are farmers who invest excess capital in animals while Fulani are herders who engage in subsistence cultivation because they have fallen on hard times.

The Marka and Fulani both base their soil categorization systems on the same perceptually-salient features of soil consistency and color. However, despite sharing the same basic principles of categorization, Marka and Fulani ethnopedological systems differ in important, if subtle, ways. For example, what the Fulani call "black sand" is not the same soil that the Marka call "black sand". For the Fulani, "black sand" refers to a type of sand that has black grains. This type of sand is only encountered in upland environments where the Fulani pasture their herds in the rainy season. For the Marka, "black sand" refers to a type of soil that mixes both sand and clay. This type of soil is found in depressions and in transitional spaces between the current floodplains and the historical floodplains. Furthermore, the Fulani frequently distinguished between two different types of crusted hardpan soils (*fero* and *kaje*) found in highlands, whereas the Marka only had one named type of soil for these areas. Crusted soils are marginally useful and often avoided by Marka farmers, but are regularly exploited by herders (largely because they have not been converted into fields by farmers). These differences reveal how Marka and Fulani ethnopedological systems, despite being based on the same observable

qualities, are shaped by differential exposure to and use of the landscape. The Fulanis' knowledge base is founded on their experiences as extensive pastoralists. This entails familiarity with a broader geographic area and looking at the landscape in terms of its quality as pasture. On the other hand, Markas' knowledge is much more localized and based on looks at the landscape in terms of its potential as agricultural space.

Soil typologies provide a useful starting point for research on local knowledge of soils, but an applied and theoretically informed ethnopedology must incorporate a wider variety of data that relate to knowledge of soils. In addition to soil typologies, ethnopedological research must also elicit knowledge of dynamic agroecological processes that impact soil quality and soil management. Marka and Fulani models of agroecological processes are fundamentally similar, but their management strategies differ according to their values and strategies as agropastoralists. Fallowing is known, but is no longer practiced to any great extent due to land shortage. Marka maintain soil fertility by keep small ruminants in household pens and transporting manure to the fields during the off season. Fulani also pen small ruminants and transport their manure to fields, but are more likely to corral cow herds in their fields in order to profit from both the urine and manure left there by the cows. This soil maintenance strategy is much less labor intensive and is perceived as being more effective. The Fulani employ this method to a much greater extent than the Marka because they have greater access to herds. This factor also contributes to the greater tendency among Fulani to value cow manure as a stronger fertilizer than small ruminant manure, which is contrary to the Markas' universally shared belief that small ruminant manure is stronger than cow manure.

For an even more complete understanding of technical knowledge of soils and soil management, ethnopedological systems need to be situated in broader social contexts, such as

land tenure practices, historical power relations, ethnic identities, and rural development policies. All of these institutions shape individual resource-management decision-making. For example, differences in agricultural and pastoral land tenure have been strongly shaped by all of the factors above. Tenure on agricultural fields is very secure, as long as it granted by the village chief of one's own village. The only occasion where one's own village chief would take away a field is in requisitioning that field for construction of village residences. This is a slow and easily foreseeable process, enabling a farmer to anticipate losing a field several years in advance and compensate accordingly. Agricultural land tenure is least secure in cases where someone is granted use rights to a field in the territory of a different village. In these cases, the village chief of the controlling village can rescind fields any year he likes.

In contrast to the relative security of agricultural land tenure, security of land tenure for upland pasture is unstable. The Fulani Dina of the early and mid 19th century was able to institute pro-pastoral land management policies through the organization and exertion of Fulani military strength rationalized with theocratic ideologies. Their land tenure institutions survived the fall of the Dina, the rise and fall of colonialism, and post-colonial regimes to the present. However, the ecological, social and political environments have changed drastically in that time and current policy trends are tending toward favoring sedentary agriculturalists' power over land resources. Despite the formalization of land-management in the interior of the Delta, Fulani herders do not have any formal tenure on upland pastures or the trails that connect the upland and lowland pastures. Access to and maintenance of the trails that lead between the lowland pastures in the Niger River Inland Delta and surrounding upland pastures is highly contested. This condition is exacerbated by increasing pressure on the land by both farmers and herders, as well as vague and sometimes contradictory land tenure laws over the trails. The contemporary policies of

decentralization have contributed to this confusion by giving local agricultural villages along the trail a claim to ownership and management of the trails despite their customary standing as national pastoral commons resources. The contestation of land tenure and changing policy regimes are important factors in understanding how local knowledge systems of land management continue to be situated in dynamic power relations.

Similarly, local knowledge systems are also situate in dynamic interactions of ethnic identity and idealized subsistence strategies. There are many ethnic groups in the southern delta region, but the Marka are foremost among the ones for whom farming is a central part of their ethnic identity. Conversely, cattle herding is a fundamental part of Fulani identity. The association of Fulani with cattle is further reinforced by the fact that the Fulani are the only ethnic group in the region who has traditionally practiced pastoralism[1]. Most Marka and Fulani now rely on a mix of farming and pastoralism, but, both Marka and Fulani consider their historic subsistence strategy and associated lifestyles as a major aspect of their collective identity, sometimes regardless of their actual behaviors and economic activities. Ideologies linking specific subsistence strategies with ethnic identity affect decision-making and political positioning even when actors do not have a direct material interest in that particular subsistence strategy. For example, some Fulani who neither own nor herd any cattle expressed preferences for land management practices and policies that favor pastoralism over agriculture.

Exertions and counter-exertions of power between farmers and herders, at the individual, local and national levels, reflect competition over control of land resources by user-groups that have ethnically-linked land-use interests. Although there are significant differences between Marka and Fulani ethnopedological systems, they are relatively minor in comparison to

[1] Only in the last couple of decades Tomashek herders from the northern part of the delta have begun migrating more to the south, though in relatively small numbers. There is some evidence from areas other than Madiama that this migration has precipitated some tension between Fulanis and Tomasheks.

differences between their ideologies of ethnic identity and subsistence strategy. These cultural ideologies affect their land and herd management practices as well as their perspectives on land-use conflicts. Markas favor policies and positions that promote increased local control over land use, intensification of herding and the maintenance of relatively extensive farming practices. The Fulani favor policies and positions that call for greater intervention by the state to secure access to essential pasture resources that are rapidly being enclosed and converted by fields. This would promote the intensification of agriculture and the maintenance of relatively extensive pastoralism. The intensification of both agriculture and pastoralism is already well underway, but the two groups maintain ethnically-linked ideologies that favor the greater intensification of their secondary or less-preferred subsistence activity.

Implications

Under recent policies of decentralization in Mali, the balance of power over land-use has tilted toward sedentary agriculturalists. The shifting balance of power marginalizes pastoralism, a sector that is culturally, economically, and agroecologically important part of the NRID. One of the implicit goals of decentralization is that rural producers, both farmers and herders, should intensify their production methods. Land-shortage, demographic growth and severe declines in rainfall also create pressure for intensification of both agriculture and pastoralism. However, democratic and participatory development efforts need to consider competing notions of how land should be managed and how intensification should proceed. Pasture resources in central Mali have traditionally been exploited in a highly extensive fashion and pastoralists do not have secure tenure over them. Fulani cultural identity is closely linked with the lifestyle of extensive transhumant pastoralism. Consequently, intensification of the pastoral sector may be difficult for the Fulani for both ideological and institutional (tenurial) reasons. However, the economic and

agroecological importance of pastoralism to the NRID and across the Sahel requires that issues of pastoral resource tenure and production strategies are clearly and directly addressed. Accomplishing this may be difficult in a policy environment that emphasizes localization of control over land.

Starting from a simple ethnopedological study of farmers' soil typologies, this dissertation has integrated the topics of land tenure institutions and practices, agricultural and pastoral interactions, rural development, ecological change, ethnic identity, ethnic relations, and political history. All ethnoecological knowledge is necessarily situated in these broader social, historical and political contexts, and in many ways cannot be extracted from them. It has been my goal for this dissertation to move ethnopedology beyond typologies and link it with historical and political ecological processes for a more interdisciplinary perspective on people's relationships with the land and with each other.

Marka and Fulani cognized models of the environment and their places within it are the result of their different historical relationships in that environment. These cognized models have not only shaped ethnic perceptions and prioritizations of natural resources, but they have also guided ethnic political behavior under conditions of natural resource conflict. Marka and Fulani cultural ideologies shape perceived opportunities and constraints for the future of rural development in central Mali.

WORKS CITED

no author

1999 Recueil des textes Legistlatif et teglementaires en matiere de gestion de rousource forestieres faunique et halieutique. *In* IV. Governement of Mali, Vol. 2.

Abaye, Ozzie, et al.

2005 Controlled grazing: botanical response and animal performance. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 211-228. Wallingford: CAB International.

Agrawal, Arun

1995 Dismantling the divide between indigenous and scientific knowledge. Development and Change 26:413-439.

Altieri, Miguel

1993 Ethnoscience and biodiversity: Key elements in the design of sustainable pest management systems for small farmers in developing countries. Agriculture, Ecosystems and Environment 46:257-272.

Andah, Bassey

1993 Identifying early farming traditions of West Africa. *In* The Archaeology of Africa: Food, Metal and Towns. T. Shaw, P. Sinclair, B. Andah, and A. Okpoko, eds. Pp. 240-254. One World Archaeology. New York: Routledge.

Andah, Bassey, Wai

1981 West Africa before the seventh century. *In* Ancient Civilisations of Africa. G. Mokhtar, ed. Pp. 593-619. General History of Africa, Vol. 2: UNESCO.

Badini, Oumarou , Boureima Traoré, and Mohamed Sidi Mohamed Touré

2005 Biophysical assessment of alternative soil fertility technologies through modelling. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 143-158. Wallingford: CAB International.

Badini, Oumarou, and Lassana Dioni

2005 Landscape and soil characterization of Madiama commune. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 35-52. Wallingford: CAB International.

Ballo, Adama, and Abdoul Karim Outtara

2005 Investigation into the movements of cattle, sheep and goat herds through the Commune of Madiama. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 53-70. Wallingford: CAB International.

Barrera-Bassols, N., and J. A. Zinck

2003 Ethnopedology: A worldwide view on the soil knowledge of local people. Geoderma 111:171-195.

Barriosa, E. , and M.T. Trejob

2003 Implications of local soil knowledge for integrated soil management in Latin America. Geoderma 111:217-231.

Barth, Frederik
1956 Ecologic relationships of ethnic groups in Swat, North Pakistan. American Anthropologist 58:1079-1089.
Batran, A.
1989 The nineteenth century Islamic revolutions in West Africa. *In* Africa in the nineteenth century unitl the 1880's. A.F. Ade Ajayi, ed. Pp. 537-554. General History of Africa, Vol. 6. Oxford: Heinemann International.
Behrens, C.
1989 The scientific basis for Shipibo soil classification and land use: Changes in soil-plant associations with cash cropping. American Anthropologist 91:83-100.
Bellon, Maurice, and J. Taylor
1993 Folk taxonomy and the partial adoption of new seed varieties. Economic Development and Cultural Change 41(4):763-786.
Benjaminsen, Tor A.
1997 Natural resource management, paradigm shifts, and the decentralization reform in Mali. Human Ecology 25(1):121-143.
Bennett, John
1969 Northern plainsmen: Adaptive strategy and agrarian life. Chicago: AHML Publishing.
Berlin, Brent
1992 Ethnobiological classification: Principles of categorization of plants and animals in traditional societies. Princeton: Princeton University Press.
Berlin, Brent, David Breedlove, and Peter Raven
1973 General principals of classification and nomenclature in folk biology. American Anthropologist 75:214-242.
Bingham, Sam
2005 Holistic management applied to SANREM research and develpment in Madiama. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 117-128. Wallingford: CAB International.
Boahen, A. A.
1989 New trends and processes in Africa in the nineteenth century. *In* Africa in the nineteenth century unitl the 1880's. A.F. Ade Ajayi, ed. Pp. 40-63. General History of Africa, Vol. 6. Oxford: Heinemann International.
Boster, J.
1984 Classification, cultivation and selection of aguaruna cultivars of *Manihot esculenta*. Advances in Economic Botany 1:34-47.
Boster, James
1996 Human cognition as a product and agent of evolution. *In* Redefining nature: Ecology, culture and domestication. R. Ellen and K. Fukui, eds. Pp. 269-290. Explorations in Anthropology. Oxford: Berg.
Brewster, Charlene, et al.
2005 Economic linkages among occupational groups in the Madiama commune. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 181-194. Wallingford: CAB International.

Brokensha, David, Michael Warren, and Oswald Werner, eds.
1980 Indigneous knowledge systems and development. Washington DC: University Press of America.
Brooks, George
1986 A provisional historical scehma for western Africa ased on seven climate periods (ca 9000 BC to teh 19th century). Cahiers d'etudes africaines 101-102(1-2):43-62.
Brosius, J. Peter
1997 Endangered forest, endangered people: Environmentalist representations of indigenous knowledge. Human Ecology 25(1):47-69.
Brown, C.
1976 Some general principles of biological and non-biological folk classification. American Ethnologist 3:73-85.
—
1985 Mode of subsistence and folk biological taxonomy. Current Anthropology 26(1):43-53.
Brush, Stephen
1993 Indigenous knowledge of biological resources and intellectual property rights: The role of anthropology. American Anthropologist 95(3):653-671.
Bryant, Raymond
1998 Power, knowledge and political ecology in the third world: a review. Progress In Physical Geography 22(1):79-94.
Cissé, Salmana
1985 Land tenure and development problems in Mali: The case of the Niger Delta. *In* Population, health, and nutition in the Sahel: Issues in the welfar of selected West African communities. A. Hill, ed. London: KPI.
Cissoko, S. M.
1989 The Songhay from the 12th to the 16th century. *In* Africa from the twelfth to sixteenth century. D.T. Niane, ed. Pp. 187-210. General History of Africa, Vol. 4. Oxford: Heinemann International.
Conklin, Harold
1954 An ethnoecological approach to shifting agriculture. Transactions of the New York Academy of Sciences 17:133-142.
—
1957 Hanunoo agriculture. *In* A report on an integral system of shifting cultivation in the Philippines. Rome: FAO Forestry Development.
—
1967 Ethnographic semantic analysis of Ifugao landform categories. Transaction of theNew York Academy of Sciences 30(1):91-121.
—
1972 Folk Classification. New Haven: Yale University Department of Anthropology.
Warren, D. Michael, L. Jan Slikkerveer, and David Brokensha, eds.
Connah, Graham
1981 Three thousand years in Africa: Man and his environment in the Lake Chad region of Nigeria. Cambridge: Cambridge University Press.

Council, National Research
1991 Toward sustainability: A plan for collaborative research on agriculture and natural resource management. Washington DC: Narional Academy Press.
Curtin, Phillip
1995a Africa north of the forest in the early Islamic age. *In* African history: from earliest times to independence. P. Curtin, S. Feierman, L. Thompson, and J. Vansina, eds. London: Longman.
—
1995b The commercial and religious revolutions in West Africa. *In* African history: from earliest times to independence. P. Curtin, S. Feierman, L. Thompson, and J. Vansina, eds. London: Longman.
—
1995c The West African coast in the era of the slave trade. *In* African history: from earliest times to independence. P. Curtin, S. Feierman, L. Thompson, and J. Vansina, eds. London: Longman.
Daget, S.
1989 The abolition of the slave trade. *In* Africa in the nineteenth century unitl the 1880's. A.F. Ade Ajayi, ed. Pp. 64-89. General History of Africa, Vol. 6. Oxford: Heinemann International.
de Boef, Walter, et al., eds.
1993 Cultivating knowledge: Genetic diversity, farmer experimentation, and crop research. London: Intermediate Technology Publications.
de Bruijn, Mirjam
1997 The hearthhold in pastoral Fulbe society, central Mali: Social relations, milk and drought. Africa 67(4):625-651.
DeWalt, Billie R.
1994 Using Indigenous knowledge to improve agriculture and natural resource management. Human Organization 53(2):123-131.
Dialla, B. E.
1993 The Mossi indigenous soil classification in Burkina Faso. Indigenous Knowledge and Development Monitor 1(3):17-18.
Diop, Birago
1961 Les nouveaux contes d'Amadou Koumba. Paris: Presence Africaine.
Dyson-Hudson, Rada, and Neville Dyson-Hudson
1980 Nomadic Pastoralism. Annual Review of Anthopology 9:15-61.
Earl, Julia, and Amadou Kodio
2005 Participatory Landscape/Lifescape Appraisal. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 77-88. Wallingford: CAB International.
Ellen, Roy
2002 'Déjà vu, all over again', again: reinvention and progress in applying local knowledge to development. *In* Participating in development: approaches to indigenous knowledge. P. Sillitoe, A. Bicker, and J. Pottier, eds. Pp. 162-188. ASA Monographs 39. London: Routeledge.

Ellis, David, and Paige West
2004 Local history as 'indigenous knowledge': Aeroplanes, conservation and development in Haia and Maimafu, Papua New Guinea. *In* Investigating local knolwedge: New directions, new approaches. A. Bicker, P. Sillitoe, and J. Pottier, eds. Pp. 105-127. Aldershot, UK: Ashgate Publishing.
Erickson, P.J., and M Ardon
2003 Similarities and differences between farmer and scientists view on soil quality issues in Honduras. Geoderma 111:233-248.
Escobar, Arturo
1999 Steps to an antiessentialist political ecology. Current Anthropology 40(1):1-30.
Fairhead, James
1993 Representing knowledge: The 'new farmer' in research fashions. *In* Practising development: Social science perspectives. J. Pottier, ed. Pp. 187-204. London: Routeledge.
Fairhead, James, and Melissa Leach
1995 False forest history, complicit social analysis: Rethinking some West African environmental narratives. World Development 23(6):1023-1103.
—
1996 Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic. Cambridge: Cambridge University Press.
Frake, C.
1962 Cultural ecology and ethnography. American Anthropologist 64(1):53-59.
Fratkin, Elliot
1997 Pastoralism: Governance and development issues. Annual Review Of Anthropology 26:235-261.
Furbee, L.
1989 A folk expert system: soils classification in the Colca Valley, Peru. Anthropological Quarterly 62(2):83-102.
Gallais, Jean
1967 Le Delta intterieur du Niger: Etude de geographie regionale. 2 vols. Volume 1. Dakar: IFAN.
Gobin, A., et al.
2000 Integrated toposequence analyses to combine local and scientific knowledge systems. Geoderma 97:103-123.
Goebel, Jeff, Catherine Ampagoomian, and Abdoulaye Touré
2005 Conflict management training. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 101-116. Wallingford: CAB International.
Goodenough, Ward
1957 Cultural Anthropology and Linguistics. Seventh Annual Table Meeting in Linguistics and Language Study, Georgetown University, 1957. Vol. 9.
Gray, Leslie C., and Philippe Morant
2003 Reconciling indigenous knowledge with scientific assessment of soil fertility changes in southwestern Burkina Faso. Geoderma 111:425-437.
Greenberg, James, and Thomas Park
1994 Political ecology. Journal of Political Ecology 1(1):1-12.

Grossman, J.M.
2003 Exploring farmer knowledge of soil processes in organic coffee systems of Chiapas, Mexico. Geoderma 111:267-287.
Grove, A.T.
1993 Africa's climate in the Holocene. *In* The Archaeology of Africa: Food, Metal and Towns. T. Shaw, P. Sinclair, B. Andah, and A. Okpoko, eds. Pp. 32-42. One World Archaeology. New York: Routledge.
Guillet, David
1989 A knowledge-based-systems model of native soil management. Anthropological Quarterly 62(2):59-68.
Gupta, Anil K.
1989 Scientists' views of farmers' practices in India: Barriers to effective interaction. *In* Farmer first: Farmer innovation and agricultural research. R. Chambers, A. Pacey, and L.A. Thrupp, eds. Pp. 24-30. London: Intermediate Technology.
Harlan, Jack
1993 The tropical African cereals. *In* The Archaeology of Africa: Food, Metal and Towns. T. Shaw, P. Sinclair, B. Andah, and A. Okpoko, eds. Pp. 53-60. One World Archaeology. New York: Routledge.
Hodgson, Dorothy L.
2002 Precarious alliances: The cultural politics and structural predicaments of the indigenous rights movement in Tanzania. American Anthropologist 104(4):1086-1097.
Howes, M., and Robert Chambers
1980 Indigenous technical knowledge: Analysis, implications and issues. *In* Indigenous knowledge systems and development. D. Brokensha, D. Warren, and O. Werner, eds. Lanham, MD: University Press of America.
Hunn, Eugene
1982 The utilitarian factor in folk biological classifications. American Anthropologist 84(4):830-847.
Kassam, Aneesa
2002 Ethnotheory, ethnopraxis: Ethnodevelopment in the Oromai regional state of Ethiopia. *In* Participating in development: approaches to indigenous knowledge. P. Sillitoe, A. Bicker, and J. Pottier, eds. Pp. 64-81. ASA Monographs 39. London: Routeledge.
Kerven, C., H. Dolva, and R. Renna
1995 Indigenous soil classification systems in Northern Zambia. *In* The Cultural Dimensions of Development: Indigenous Knowledge Systems. D. Warren, L. Slikkerveer, and D. Brokensha, eds. Pp. 82-87. London: Intermediate Technologies.
Krasilnikov, Pavel V., and Joe A. Tabor
2003 Perspectives on utilitarian ethnopedology. Geoderma 111:197-215.
Latour, Bruno
1986 Visualization and cognition: Thinking with eyes and hands. Knowledge and Society 10:1-40.
Leach, Melissa and James Fairhead
2000 Fashioned forest pasts, occluded histories? International environmental analysis in West African locales. Development and Change 31:35-59.

Lode, Kåre
1997 The peace process in Mali: Oiling the works? Security Dialogue 28(4):409-424.
Ly-Tall, M.
1989a The decline of the Mali empire. *In* Africa from the twelfth to sixteenth century. D.T. Niane, ed. Pp. 172-186. General History of Africa, Vol. 4. Oxford: Heinemann International.
—
1989b Massina and the Torodbe (Tukuloor) empire until 1878. *In* Africa in the nineteenth century unitl the 1880's. A.F. Ade Ajayi, ed. Pp. 600-635. General History of Africa, Vol. 6. Oxford: Heinemann International.
Maley, J.
1993 The climatic and vegetational history of the equatorial regions of Africa during the upper Quaternary. *In* The Archaeology of Africa: Food, Metal and Towns. T. Shaw, P. Sinclair, B. Andah, and A. Okpoko, eds. Pp. 43-52. One World Archaeology. New York: Routledge.
Masonen, Pekka
1997 Trans-Saharan trade and the West African discovery of the Mediterranean. *In* Ethnic encounter and the culture change: Papers from the Third Nordic Conference on Middle Eastern Studies. M.h. Sabour and K.S. Viker, eds. Pp. 116-142. Nordic Research on the Middle East, Vol. 3: Bergen.
McIntosh, Susan, and Roderick McIntosh
1993 Cities without citadels: understanding urban origins along the Middle Niger. *In* The Archaeology of Africa: Food, metal and towns. T. Shaw, P. Sinclair, B. Andah, and A. Okpoko, eds. Pp. 622-641. One World Archaeology. New York: Routledge.
Moore, Keith, ed.
2005 Conflict, social capital and managing natural resources: a West African case study. Cambridge, Massechusettes: CAB International.
Moore, Keith, and Salmana Cissé
2005 Social capital and improved NRM. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 229-246. Wallingford: CAB International.
Moore, Keith, Salmana Cissé, and Abdoulaye Touré
2005 Building social infrastructure for sustainable development. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 89-100. Wallingford: CAB International.
Moseley, William, Julia Earl and Lassine Diarra
2001 La décentralisation et les conflits agriculteurs - éleveurs dans le delta intérieur du Niger: quelles échelles de gestion communautaire des ressources naturelles? *In* La Gestion Intégrée des Ressources Naturelles en Zones Inondables Tropicales. Paris: IRD.
Muzzolini, A.
1993 The emergence of a food-producing economy in the Sahara. *In* The Archaeology of Africa: Food, Metal and Towns. T. Shaw, P. Sinclair, B. Andah, and A. Okpoko, eds. Pp. 227-239. One World Archaeology. New York: Routledge.
Nader, Laura, ed.
1996 Naked science: Anthropological inquiry into boundaries, power, and knowledge. London: Routeledge.

Nazarea, Virginia
1998 Cultural memory and biodiversity. Tucson: University of Arizona Press.
—
1999 A view from a point: Ethnoecology as situated knowledge. *In* Ethnoecology: Situated knowledge/located lives. V. Nazarea, ed. Pp. 3-20. Tucson: University of Arizona.
Nazarea-Sandoval, Virginia
1995 Local knowledge and agricultural decision-making in the Philippines: Class, gender and resistance. Ithica: Cornell University Press.
Netting, Robert McC.
1968 Hill farmers of Nigeria: Cultural ecology of the Kofyar of the Jos Plateau. Seattle: University of Washington Press.
—
1993 Smallholders, householders: Farm families and the ecology of intensive, sustainable agriculture. Stanford: Stanford University Press.
Niane, Djibril Tamsir
1965 Sundiata: an epic of old Mali. Essex: Longman.
—
1989 Mali and the second Mandingo expansion. *In* Africa from the twelfth to sixteenth century. D.T. Niane, ed. Pp. 115-171. General History of Africa, Vol. 4. Oxford: Heinemann International.
Niemeijer, David, and Valentina Mazzucato
2003 Moving beyond indigenous soil taxonomies: Local theories of soils for sustainable development. Geoderma 111:403-424.
Norgaard, Richard
1984 Traditional agricultural knowledge: Past performance, future prospects and insitutional iimplications. American Journal of Agricultural Economics 66:874-78.
Oliver, Roland, and Anthony Atmore
2001 Medieval Africa: 1250 - 1800. Cambridge: Cambridge University Press.
Osbahr, Henny, and Allan Christie
2003 Indigenous knowledge of soil fertility management in southwest Niger. Geoderma 111:457-479.
Osunade, M. A. A.
1988 Soil suitability classification by small farmers. The Professional Geographer 40(2):194-201.
—
1992 The identification of crop soils by small farmers of South-western Nigeria. Journal of Environmental Management 35:193-203.
Oudwater, Nicoliene, and Adrienne Martin
2003 Methods and issues in exploring local knowledge of soils. Geoderma 111:387-401.
Painter, Thomas, James Sumberg, and Thomas Price
1994 Your *terroir* and my 'action space': Implications of differentiation, mobility and diversification for the *approche terroir* in Sahelian West Africa. Africa 64(4):447-463.
Phillipson, David
1993 African archaeology. Cambridge: Cambridge University Press.

Platteau, Jean-Phillipe
1996 The evolutionary theory of land rights as applied to Sub-Saharan Africa: A critical assessment. Development and Change 27:29-86.
Purcell, Trevor
1998 Indigenous knowledge and applied anthropology: Questions of definition and direction. Human Organization 57(3):258-272.
Ramos, Alcida Rita
1998 Indigenism: Ethnic politics in Brazil. Madison: University of Wisconsin Press.
Rappaport, Roy
1979 Ecology, meaning and religion. Berkeley: North Atlantic Books.
Rhoades, Robert
1984 Breaking new ground: Agricultural anthropology. Lima: International Potato Center.
—
2001 Breaking new ground: Linking research, participation and sustainable development. *In* Bridging human and ecolgical landscapes: Participatory research and sustainable development in an Andean agricultural frontier. R. Rhoades, ed. Dubuque, Iowa: Kendall/Hunt.
—
2005 Agricultural Anthropology. *In* Applied anthropology : Domains of application. S. Keida and J. van Willigen, eds. Westport, CN: Praeger.
Rhoades, Robert , and Anthony Bebbington
1995 Farmers who experiment: An untapped resource for agricultural research and development. *In* The cultural dimension of development: Indigenous knowledge systems. D.M. Warren, L.J. Slikkerveer, and D. Brokensha, eds. London: Intermediate Technology Publications.
Rhoades, Robert, and Robert Booth
1982 Farmer-back-to-farmer: A model for generating acceptable agricultural technology. Agricultural Administration 11:127-137.
Richards, Paul
1985 Indigenous agricultural revolution: Ecology and food crop farming in West Africa. London: Hutchinson.
—
1986 Coping with hunger: hazard and experiment in an African rice farming system. London: Allen and Unwin.
Riesman, Paul
1974 Freedom in Fulani social life: An introspective ethnography. M. Fuller, transl. Chicago: University of Chicago Press.
Sawyer, Suzana
2004 Crude chronicles: Indigenous politics, multinational oil and neoliberalism in Ecuador. Durham: Duke University Press.
Scott, James
1998 Seeing like a state: How certain schemes to improve the human condition have failed. New Haven: Yale University Press.

Sillitoe, Paul
1996 A place against time: Land and environment in the Papua New Guinea highlands. Amsterdam: Harwood.
—
1998 The development of indigenous knowledge: A new applied anthropology. Current Anthropology 39(2):223-252.
Stonich, Susan
1993 I am destroying the land: The political ecology of poverty and environmental destruction in Honduras. Boulder: Westview Press.
—
1996 Development, rural impoverishment, and environmental destruction in Honduras. *In* The social causes of environmental destruction in Latin America. M. Painter and W. Durham, eds. Linking Levels of Analysis. Ann Arbor: University of Michigan Press.
Sylvain, Renée
2002 "Land, water and truth": San identity and global indigenism American Anthropologist 104(4):1074-1085.
Talawar, Shankar , and Robert Rhoades
1998 Scientific and local classification and management of soils. Agriculture and Human Values 15:3-14.
Traoré, Issa Baba
1989 Au coin du feu: Legendes du pays Bamana. Bamako: Editions Jamana.
Vengroff, Richard
1993 Governance and the transition to democracy: Political parties and the party system in Mali. The Journal of Modern African Studies 31(4):541-562.
Warren, Andrew , et al.
2003 Indigenous views of soil erosion at Fandou Beri, southwestern Niger. Geoderma 111:439-456.
Warren, D. Michael
1998a Commentary on Paul Sillitoe, The development of indigenous knowledge: The new applied anthropology. Current Anthropology 39(2):244-245.
Warren, D. Michael, L. Jan Slikkerveer, and David Brokensha, eds.
1995 The cultural dimension of development: Indigenous knowledge systems. London: Intermediate Technologies.
Warren, Kay B.
1998b Indigenous movements and their critics: Pan-Maya activism in Guatemala: Princeton University Press.
Warren, Kay B., and Jean E. Jackson, eds.
2002 Indigenous movement, self-representation, and the state in Latin America. Austin: University of Texas Press.
Williams, B., and C. Ortiz-Solario
1981 Middle American folk soil taxonomy. Annals of the Association of American Geographers 71(3):335-358.

WinklerPrins, A.M.G.A.
1999 Local soil knowledge: a tool for sustainable land management. Society and Natural Resources 11(7):151-161.
Wyeth, Peter, et al.
2005 An economic evaluation of alternative soil management technologies. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 159-180. Wallingford: CAB International.
Wynne, Randolph H., et al.
2005 Land use changes in Madiama commune. *In* Conflict, social capital and managing natural resources: A West African case study. K. Moore, ed. Pp. 71-75. Wallingford: CAB International.
Zimmerer, Karl
1994 Local soil knowledge: Answering basic questions in highland Bolivia. Journal of Soil and Water Conservation 49(1):29-34.

APPENDIX 1

ETHNOECOLOGY INTERVIEW SCHEDULE

Connaissance Locale sur les Sols et les Pâturages

Age
Village
Ethnie
Classe sociale

D'abord

Connaissez vous le CCGRN?

Si "non", refere á "l'association de (le representative de son village ou Issa Sao)"

Si "non" encore, laisse le tomber.

Si "oui", Qu'est-ce qu'il fait?

Decrivez *toutes* que vous connaissez sur leurs travaux (presse le sujet pour toutes les détails possible).

1. Typologie des sols

1.1 Quels sont les differents types de sols dans la Commune de Madiama ?

1.2 Parmis les sols ci-dessus, quels sont les sols cultivables?

1.3 Est-ce-qu'il y'a des sous-types du sol pour chaque type ci-dessus (1.1)?

1.4 Est-ce-qu'il y'a des subdivions pour chaque sous-type ci-dessus (1.2)? (Repetez ces questions jusqu'il ne reste plus des sous-sortes).

1.5 Est-ce-qu'on rencontre des melanges des sols?

Si oui, decrirez-les.

2. Caractérisations des Sols

2.1 Qualités et description

*** 2.1.1 Decrirez les qualités de _____. (Repetez pour chaque sorte des sols ET sous-sorte).**

2.1.2 _____ se trouve dans quels sortes des lieux (ecologiquement) ? (Repetez pour chaque sorte **ET** sous-sorte).

2.1.3 Quelles cultures sont faites dans quel types de sols?

2.2 Force

2.2.1 Classez les sortes des sols en fonction de leur force.

2.2.2 Est-ce-qu'il y'a des qualités autre que la force qui influencent votre gestions des champs par rapport de leurs cultures ? **Si oui, expliquez-la.**

*** 2.2.3 Quelles sont les causes des différences de forces dans des sols? Expliquez-la.**

2.3 Amelioration du sol

2.3.1 Qu'est-ce qu'on fait pour améliorer les sols?

2.3.2 Quelles sont des sortes d'engrais?

2.3.3 Classez les sortes d'engrais en fonction de leur force.

*** 2.3.4 Quel est la cause pour les differences de forces dans les different sortes d'engrais? (pas la description simple, mais les causes).**

*** 2.3.5** ***Continuez la chaine d'explication*****:**
Pourquoi _____ donne/cause plus de force au fumier?
Continue la chaine d'explication jusqu'a ne gagner plus des reponses**.**

2.3.6 Est-ce qu'il y a les autres choses (pas fumier) qui on peut ajouter au sols pour les ameliorer?

*** 2.3.7.1 Si paysan n'a pas encore mentionné engrais chimique, demand pourquoi pas.**

*** 2.3.7 Quelles sont les differences entre de fumier et l'engrais industriel (nógó farafin et nógó tubab).**

2.3.8.1 ***Si le paysan simplement decris leurs different qualité, demande "Mais ils sont different á cause de quoi?"***

3. <u>Typologie et caractérisation du pâturage</u>

3.1 Est-ce qu'il y'a plusieurs types de pâturages sur le plateau?
Si oui, fait une liste des differentes sortes.

3.2 Est-ce qu'il y'a plusieurs types de pâturages sur la zone exondé?
Si oui, fait une liste des differentes sortes.

4. <u>Des Espèces du Fourrage</u>

4.1 Fourrages herbacies. Fait une liste des varietés d'herbes plus preferées par

4.1.1 Des bovins

4.1.2 Des moutons et chevres

4.2 Fourrage Ligneux

4.2.1 Est-ce que vos propres animaux mangent des feuilles d'arbres ou arbustes?

4.2.2 Fais une liste des espèces d'arbres et arbustes preferés par des bovins.

4.2.3 Fais une liste des espèces d'arbres et arbustes preferés par des chevres et moutons.

4.2.4 Classez les espèces ci-dessus (4.2.2 et 4.2.3) par leur qualité comme du fourrage.

4.2.5 Quelles espèces sont mangées en brousse et quelles espèces sont coupées pour donner aux animaux?

5. Qualité et Gestion des Pâturages

5.1 Quels sont les indicateurs d'un bon pâturage?

Pour des petits ruminants

Pour des bovins

Sur le plateau & dans la plaine

(*Essaye à gagner plus des details que "Il y a beaucoup d'herbes*")

5.2 Qu'est-ce qui peut degrader ou diminuer la qualité d'un bon pâturage?

5.3 Qu'est-ce qu'on fait si un pâturage ne suffit plus?

5.4 Est-ce qu'on peut gérer un pâturage que ne suffit plus pour faire l'ameliorer?

Si "oui", comment?

6. Conflits entre des producteurs

6.1. Quels-sont les causes (immediate et globale) des conflits entre éleveurs et cultivateur dans cette zone ?

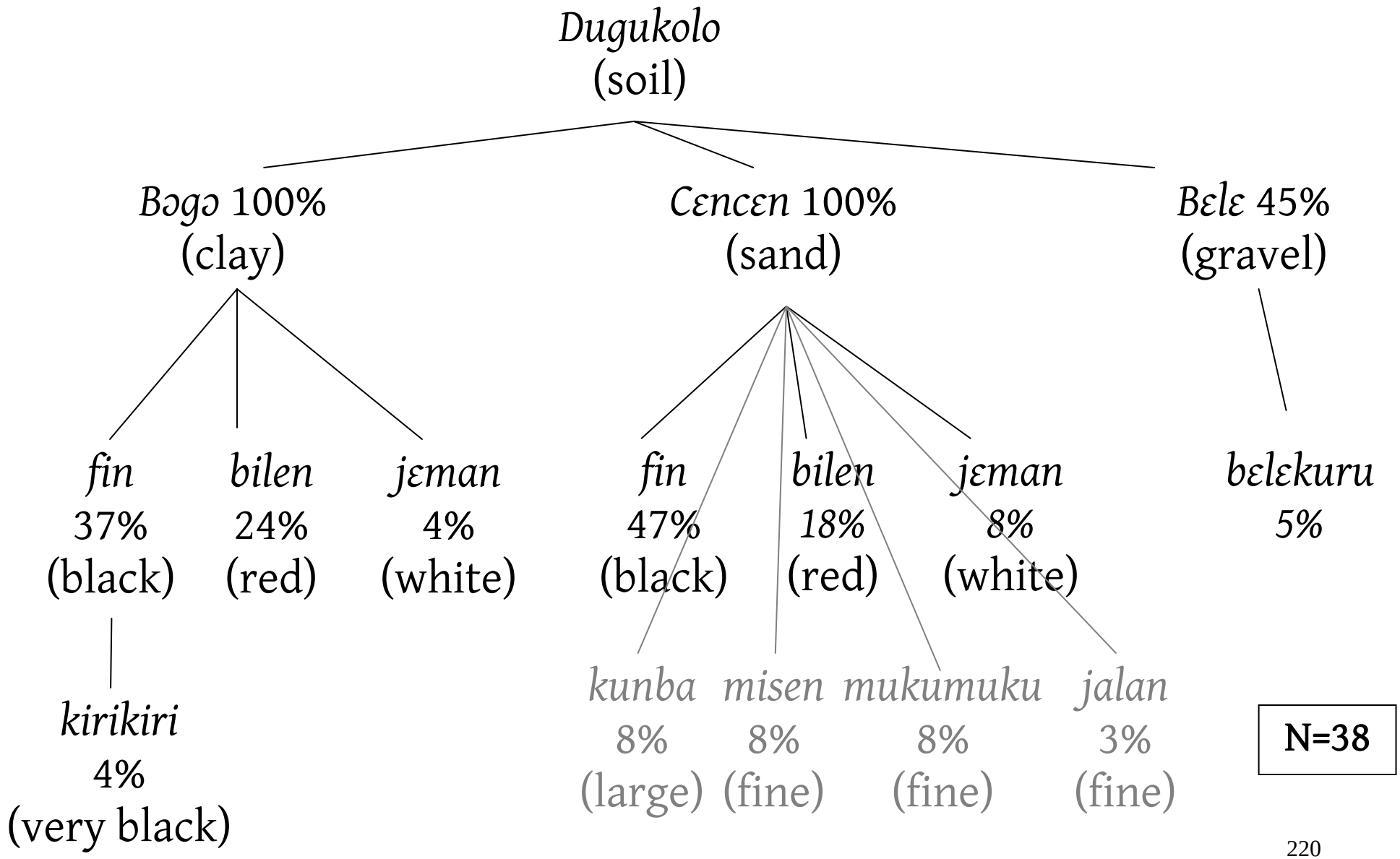
6.2. A ton avis, qu'est-ce-que'on peut faire dans la Commune de Madiama pour diminuer les conflits entre eleveur et cultivateur dans de façon qui permeta les deux á satisfaire leur besions productifs ?

** Si quelqu'un dirait "C'est le travail de Dieu" ou quelque chose pareil, *il faut le noter, mais ne l'accepte pas immediatement.* Par example, on peut repondre "Toute les choses du monde sont le travail de Dieu, mais on peut les comprendre et expliquer jusqu'à un point." Si, une deuxieme fois, quelqu'un insistait que il ne peut que dire "C'est le travail de Dieu", on peut l'accepter.

** Vous doivez ecrire le noms de chaque especes mentionnées dans la langue national.

** Pour chaque question en **lettres grandis**, il faut ecrire les propres mots du répondant.

Appendix 2: Marka Soil Typology



APPENDIX 3

MARKA CHARACTERIZATIONS OF *CƐNCƐN* SOIL

We cultivate millet in *cɛncɛn* because it is light and it lets water past it. Millet doesn't' like a lot of water. We also cultivate watermelon in *cɛncɛn.*

During the rainy season it is solid, in the hot season it doesn't stick together. It moistens easily and it dries easily. *Nɔgɔ* runs out of it easily. It is a soil for millet. It also is good for peanuts, beans and the watermelon.

Cɛncɛn doesn't hold together. Water enters it easily, but it also dries easily. It has no plasticity.

In *cɛncɛn*, there is more sand than earth. It is very permeable, and it become crumbly when it is dry. It needs less water than other soils.

Cɛncɛn is supple, it moistens easily and it also dries easily. It is easy to cultivate even when it is dry. *Cɛncɛn* is found between *bɛlɛ* and *bɔgɔ.*

Cɛncɛn is found on the tops of elevations in the land.

Cɛncɛn is found on hills and high places.

Cɛncɛn is found in higher places where water doesn't sit.

Cɛncɛn is found in areas that are higher up, areas where water doesn't sit.

APPENDIX 4

MARKA CHARACTERIZATIONS OF *CƐNCƐNBILEN* SOIL

Millet and sorghum can be cultivated in *cɛncɛnfin*, but only millet can be farmed in *cɛncɛnbilen*.

Cɛncɛnbilen is a soil formed uniquely of fine sand. It is very permeable and doesn't have much *nɔgɔ.*

Cɛncɛnbilen is made of only sand and it breaks up into grains when it is dry. In the rainy season, it settles because of the rain.

APPENDIX 5

MARKA CHARACTERIZATIONS OF *CƐNCƐNFIN* SOIL

Cɛncɛnfin has *bɔgɔ* in it and is richer in *nɔgɔ* from plants. It holds water will. When dry, it is more compact that simple sand.

Cɛncɛnfin is good for the cultivation of millet or sorghum. In this kind of soil, there is generally an association of millet and sorghum.

Cɛncɛnfin is a mix of sand and black clay.

Cɛncɛn is soil made up mostly of grains of sand and sometimes black or red *bɔgɔ*, which give the names *cɛncɛnfin* and *cɛncɛnbilen*. It is very impermeable and soft. It is easy to work and it takes millet or sorghum when it is *cɛncɛnfin*. You generally plant millet and sorghum together.

Cɛncɛnfin contains malleable *bɔgɔ*. It is stronger than *cɛncɛnbilen*.

Cɛncɛnfin takes its color from the presence of *bɔgɔ* in its composition. It forms a crust on the surface when it is dry. It is a compact soil.

Cɛncɛnfin has *bɔgɔ* and *cɛncɛnfin*. When it has dried, it becomes hard. When it is very wet, it becomes muddy, it is even difficult to cultivate.

APPENDIX 6

MARKA CHARACTERIZATIONS OF *ƁƆGƆ* SOIL

Bɔgɔ holds together very strongly. Its texture is hard. It does not moisten easily, but when it is wet, it doesn't dry quickly. Bɔgɔ is very plastic and it sticks to farming tools.

Bɔgɔ is a plastic solid and needs a lot of water. It is very hard when dry, and has cracks. When it is wet, it sticks to farm tools.

Water will sit for up to 3 day on *bɔgɔ.* It is difficult to farm when it is wet.

Bɔgɔ has black appearance. It sticks a lot. When it is wet, it has a lot of plasticity. When it is dry, it is so hard that it fragments

APPENDIX 7

MARKA CHARACTERIZATIONS OF *BƆGƆFIN* SOIL

Bəgəfin is plastic and needs a lot of water. It becomes difficult to work if there is too much water and very hard when it is dry. It is black.

Bəgəfin is a soil that has plasticity. It takes a lot of water and is very hard when it is dry. It is very difficult to work, especially when it is too wet. It is a soil in which we cultivate rice or sorghum. *Bəgəfin* is a soil from low areas and depressions.

Bəgəfin is difficult to work when it rains a lot. Cultivation is done when the soil is moderately moist.

Bəgəfin is difficult to cultivate when it is dry and has cracks that come off in blocks. During the rainy season, it holds a lot of water. *Bəgəfin* is found in the plains that flood and in depressions.

Bəgəfin needs a lot of water. It has plasticity and it is very hard when we cultivate it. It has cracks when it is dry. One finds *bəgəfin* in the areas where running water accumulates and in the low parts of the plains.

APPENDIX 8

MARKA CHARACTERIZATIONS OF *BƆGƆFIN* SOIL

Bəgəbilen conserves *nəgə* for a long time. It likes a lot of water and dries out quickly. *Bəgəbilen* is found in depressions.

Bəgəbilen is less permeable than *bəgəfin* and contains less plasticity. It is a reddish color. It comes off in blocks when it is dry.

Bəgəbilen is very poor in *nəgə* and doesn't make trees and grasses grow well. It is even poorer that sandy areas. *Bəgəbilen* is found in the elevations forming the belts around depressions in the land.

Bəgəbilen is found in the low parts of slopes and around the edges of low zones. You can also find it in the plains.

APPENDIX 9

MARKA CHARACTERIZATIONS OF *BƐLƐ* SOIL

Bɛlɛ has a lot of rocks in it. It isn't good for farming, but you can farm millet there. *Bɛlɛ* is the soil of hilltops and high ground.

Bɛlɛ? I have never cultivated this kind of soil. I avoid it because it seems to be difficult to work. One cannot use a plow in this kind of soil because it can break the edge of your tools. It isn't strong because it is always covered with hardpan.

Bɛlɛ is actually gravel and earth mixed. It holds together when dry. When it is dry, its texture is very hard. Water doesn't enter its flesh easily. It does not agree with farming. *Bɛlɛ* is found in very high places, like rocky areas (on the plateau).

Bɛlɛ is composed of soil and gravel. *Bɛlɛkulu* is largely made of gravel, with less soil and more gravel.

Bɛlɛ are soils with gravel. It isn't strong because they are always covered with hardpan.

Bɛlɛ is difficult when it comes to water. Even if rains have come, water runs over it to descend [to other places]. Farming *bɛlɛ* is difficult. *Bɛlɛ* is found in hilly, rocky areas.

Bɛlɛ has a lot of gravel and rocks and even very hard crusts. *Bɛlɛ* is found on the plateau and at the top of slopes.

APPENDIX 10

MARKA CHARACTERIZATIONS OF SOIL STRENGTH

Plasticity of a soils shows its force. The more supple it is, the more force it has.

Nəgə and mana which are found in soil are their strength.

The causes for the differences in force are plasticity, *nəgə bəgə* and the black color.

In addition to *nəgə* and ways of taking on water, plasticity and its clayness (*bəgəya*) show strength.

A soil has more force when it has a lot of *bəgə* and *mana*. It takes a lot of decomposed *nəgə*. Black soils are more plastic and have more *nəgə*. Their needs in water are greater.

The difference of force in soils is in the plasticity, the amount of *nəgə* in the soil, and how long water stays in the soil.

Nəgə and *mana* are a soil's strengths. *Mana* means that soil holds together. It becomes hard.

In any soil, if there is *mana*, if there is *nəgə*, and if it holds water well, that soil's strength is great.

APPENDIX 11

MARKA CHARACTERIZATIONS OF ORGANIC FERTILZER

Goat and sheep manure is very small and mixes quickly with the soil. It is not carried away by rainwater. Termites affect this sort of manure quickly. Cow manure is a very light manure and it is quickly transported by running water. The manure of small ruminants is heavier and descends into the soil vertically.

Small ruminants eat the leaves of trees and tree roots go all the way down to ground water. Because trees take water and *nəgə* from deep soil. Grasses don't go that deep, so the cows who eat these grasses don't give manure that is as strong as small ruminant manure.

Small ruminant *nəgə* is in the form of grains. It lasts in the soil up to 4-5 years. Small ruminants eat trees and cows eat grasses. The strength of trees is greater than that of grasses. Trees are in place for many years. Grasses grow and die every year. Tree roots descend deeply beneath the ground to get food and water all the time.

Small ruminants' food, tree leaves, is heavier than cows' food. Small ruminants manure lasts in the soil longer than all other *nəgə*.

Small ruminants eat a lot of different things, like trees. They digest their food very well. Their manure is in pellets, so it lasts a long time in the soil. Cow *nəgə* is digested grasses. Grass roots don't descend into the ground very far, not like trees.

Small ruminants like leaves more than grasses. Trees get food from the soil that grasses don't get. Trees are well fed all the time.

Goats and sheep eat tree leaves. The trees live long times. The roots of trees descend very deeply into the soil. They find a lot of water and places rich in *nəgə*. Cows eat grasses which are not very rich like trees. The don't live as long and the roots don't go very deep. Cows also eat some tree leaves. Horses and donkeys only eat grasses.

Small ruminants eat trees that have roots which go all through the soil in order to take up *nəgə* and water. That is why small ruminant manure has more force. Cows eat grasses that grow up again every year.

Small ruminants eat tree leaves which have deep roots and many roots that go in several directions. These roots take *nəgə* from the soil and water. Cows eat mostly grasses that are not as strong as trees.

APPENDIX 12

MARKA CHARACTERIZATIONS OF CHEMICAL FERTILZER

Tubabu nəgə's strength is great for only one year. When it is gone, you have to add it again every year.

All *farafin nəgə* lasts in soils longer than *tubabu nəgə*. *Tubabu nəgə* has strength for only one year because of the way it is made.

Farafin nəgə is stronger than *tubabu nəgə* because *tubabu nəgə* needs more water. *Farafin nəgə* lasts in the soil because its creation is not complete and its transformation decomposes in the soil over several years. *Tubabu nəgə* is a finished product for short-term needs.

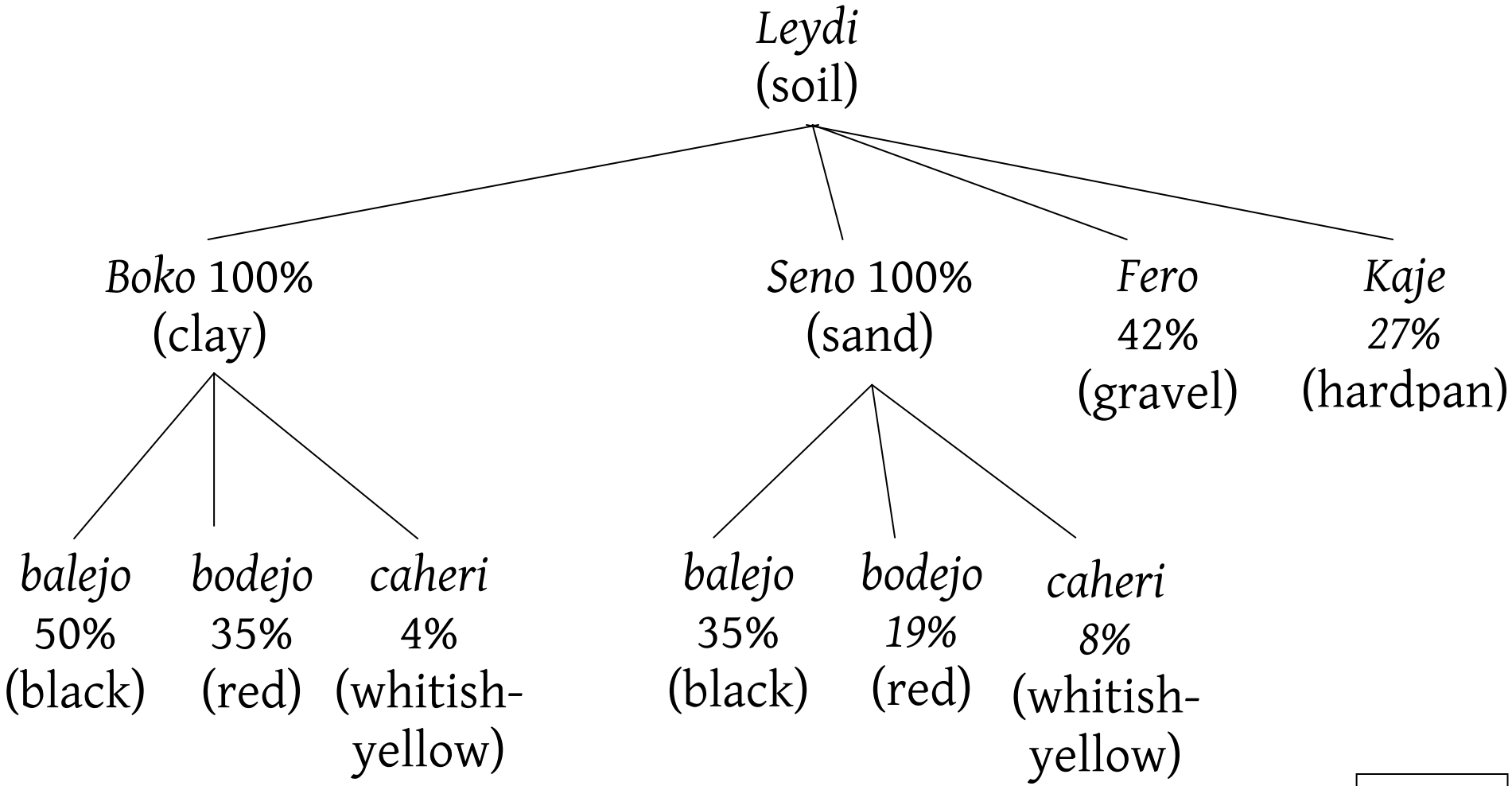
Engrais does more damage that benefit for us. It needs a large amount of water. I don't know what they are made out of.

Tubabu nəgə has immediate effect, but it doesn't last in the soils. It is made to satisfy the needs of the plants.

Tubabu nəgə doesn't last more than one year in the soil. Also, the amount of vitamins in it is calculated to meet the needs of the plants

All *farafin nəgə* is better than *tubabu nəgə*. They last in the soil longer than *tubabu nəgə*. *Tubabu nəgə's* limit is one year, because of the way it is made.

Appendix 13: Fulani Soil Typology



N=26

APPENDIX 14

FULANI CHARACTERIZATIONS OF *SENO* SOIL

Seno holds more moisture because water infiltrates more easily than in *lopal*, which takes on moisture slowly. In contrast, you always have to put manure in *seno* because it becomes poor very quickly.

Seno is particularly poor, but the infiltration of water is easy. It is well suited to millet and sorghum.

Seno is a poor soil that needs to have manure brought out to it or that you leave it fallow for several years. This soil holds less water, which is why we cultivate millet there.

Seno is a very poor soil, especially if it is not mixed with clay. It takes on water easily and dries out easily. That is why we only cultivate it with millet, watermelons or peanuts.

Ndiarindi is the part made of *seno*, which is higher than the areas where you find clay. You cultivate millet here. *Seno* soils are in high areas.

Ndiarindi, no matter what the quantity of rain, this type of soil produces, because it doesn't need a lot of water. Sand is very poor and you have to bring *birji* to it,

Seno's production depends on the rain, if it rains, it is good. If it rains a lot, it is mediocre. The infiltration of water is rapid and it dries rapidly too.

Ndiarindi is a reddish soil that is easy to cultivate. It is a poor soil that asks for a lot of manure.

Seno is a poor soil found on the plateau. It doesn't hold water for a very long time. In order to work it, it needs that you bring out manure for it every year, or corral your animals there. It has a reddish color.

APPENDIX 15

FULANI CHARACTERIZATIONS OF *BOKO/POPOLAL* SOIL

Popolal, also called *boko*, is a soil where we cultivate rice or sorghum because it is where rainwater pools. Because of that it is richer than *seno.*

Boko needs a lot of rain and working it is painful. Its production is good when there is a lot of rain because it is in zones of depression. *Boko* is in depressions in which draining water pools.

Popolal is strongest because it is in a zone of concentration of organic matter that is drained by the rain water. It is a zone very rich and in which one doesn't need to put manure.

Boko is the zone of concentration of rain water. It is a lot of work to cultivate. It is a rich soil that doesn't ask that you always bring a lot of manure. *Boko* is found in ponds, rice fields and low areas.

Popolal is a hard soil that is difficult to work, but it is rich and its productivity depends on the rain. If it rains a lot, the production is good even if you haven't added a lot of manure.

Boko is in depressions. We cultivate millet or sorghum when it is not too deep. If it is deep, we cultivate rice there.

Boko is harder to work than sandy and gravelly soils. It is stronger than the other two. If it rains, water is held for a longer time in *boko*.

APPENDIX 16

FULANI CHARACTERIZATIONS OF *FERO* SOIL

Fero is also called *karawal* by some. It is a soil that is hard to cultivate and becomes so poor that you have to build stone lines and bring out manure every year. The grasses and trees rarely grow on this type of soil. *Fero* is found on the plateau. And next to the rice fields.

Fero is a soil weakened by cultivations. You have to build rock lines to cultivate it. It needs to have a lot of manure brought to it because it is weak. Rainwater doesn't stay on fero soils [because it runs off]. *Fero* is a mix of gravel, sand and often clay.

Fero is a mix of gravel and other things, like sand and dust. It is very poor. *Fero* is found on elevations.

Fero is red and difficult to work even when it doesn't have much gravel. *Fero* is found in the higher parts of the plain.

Fero is a soil that is not worked. It is very poor and doesn't grow grasses or trees. Water runs off of this soil easily. This is also true of *kaje*. *Fero* is found between Madiama and Nerekoro and toward Torokoro.

APPENDIX 17

FULANI CHARACTERIZATIONS OF *KAJE* SOIL

Kaje is a soil that is difficult to work unless it is mixed with sand. The hard parts are suited mostly for *gaiki*. Infiltration of water is difficult and in order to produce a lot, there has to be a lot of rain. Also, you have to put in animal manure each year. *Kaje* is found to the east of the commune. *Kaje* plus *ndianrindi* is found here and there throughout the commune, but a lot is toward the east and south of the commune, around Toumadiama.

Kaje is found to the east of the commune. *Kaje* plus *ndiarindi* is found here and there throughout the commune, but a lot is towards the east and south of the commune, around Toumadiama.

Haïre is found on elevations, made mostly of reddish gravel, like between Madiama and Nerekoro or toward Torokoro or Toumadiama.

Kaje is on the plateau, *fero* is found on elevations,

Fero is a soil that is not worked. It is very poor and doesn't grow grasses or trees. Water runs off of this soil easily. This is also true of *kaje*.

APPENDIX 18

FULANI CHARACTERIZATIONS OF MIXED *BOKO* AND *SENO* SOIL

Ndiarindi and *boko* is a soil that is more or less hard depending on the dominance of sand or clay. It is richness in *birji* varies. We plant millet and sorghum together in this soil.

Boko plus *seno* is a mix of the two types of soil. It is a weak soil inasmuch as sand dominates and strong inasmuch as clay dominates. We cultivate it with a mix of millet and sorghum. The color is mixed and depends on whether the soil is on the plateau or near lower areas.

Seno and *popolal* mixed is a soil that varies in hardness and richness. It is relatively easy to work and its production depends on the rain. That is why we plant both millet and sorghum in the mixed soils.

Seno plus *popolal's* quality depends on the dominance of clay or the sand. That is why we cultivate millet and sorghum mixed together, because no matter how much rain falls during the season, we will harvest something.

APPENDIX 19

FULANI CHARACTERIZATIONS OF SOIL STRENGTH

The causes of the difference of strength is the location of the soil. The soils that hold a lot of moisture produce the most. That is why sand is poorer than clay.

The erosion by water moves all the elements. The lack of rain makes the soil poor and makes the trees and grasses disappear.

Seno is very poor and you have to bring manure to it, while *boko* is very rich because it is in a zone of concentration of rainwater. This type of soil doesn't need to have manure brought to it all the time.

Both *seno* and *boko* have force, but it depends on the rain.

All the qualities are linked to the rain, because no matter how rich or poor a soil is, if it doesn't rain regularly, it is nothing [it doesn't matter]. So everything depends on the rain. The causes for the differences in the soil is the rain and that is done by God.

APPENDIX 20

FULANI CHARACTERIZATIONS OF ORGANIC FERTILIZER

Goat manure is stronger than that of sheep because they nourish themselves more with tree leaves and we know that the leaves are richer than grasses in nutritive elements.

African fertilizer contains many different elements, leaves, grasses and urine, and can last years in the soil.

The reason for the differences [between manure types] is that goats eat tree leaves, whereas cows and sheep eat a lot of grasses and only a few leaves.

I also know that small ruminant manure is stronger than that of cows because small ruminants eat more tree leaves than cows. Also, the manure of small ruminants decomposes slowly and can last years in the soil, while cow manure decomposes in 2-3 years and then its strength is finished.

Manure's force depends on the types of grasses and tree leaves that the animals consume. For example, small ruminants' manure only has an effect for several years, up to 5-7 years because they eat the leaves of trees and their manure is in balls.

I know like a lot a people, that the small ruminant manure is stronger than cow manure because it is made of balls that decompose slowly while cow manure decomposes easily.

I have no knowledge of [why manures differ in strength]. Maybe because of the leaves and grasses that they eat. I know that goats like only tree leaves. That may be the reason for saying that their manure appears better than the others.

I know that the manure of goats has more force that that of sheep, which is stronger than that of cows. That is because goats eat only tree leaves.

APPENDIX 21

FULANI CHARACTERIZATIONS OF CHEMCIAL FERTILIZER

Engrais is stronger because if you put a lot in a field and it doesn't rain, the field burns. However, if it rains regularly, the production is greater than if it had only had *birji*. That also, I think that *engrais* has much more heat because of the way it is made by *tubakus*.

Engrais is made by *tubakus* according to their knowledge, while manures are made according to the leaves and grasses that are eaten by the animals.

I didn't mention *engrais* because we don't use it. We have animals and *engrais* requires money. And also, I think that *engrais* is more used in the cultivation of cotton and corn. We don't do these crops. But I know that *engrais* is stronger than *birji* because a little engr*a*is can allow a good production. However, we don't use it here because it requires a lot of rain.

For me, *engrais* is only one element, while animal *birji* is made up of three elements: urine, manure and remnants of crop residues.

I didn't mention *engrais* because I have animals and the manure that they give suffices for me.

The difference in force between *engrais* and manure and *tiddere* is that if it rains only a little, *engrais* burns the plants while the manure and *tiddere* don't do that. It is also because *engrais* contains a lot of heat, which requires a lot of rain.

The principal difference is that the engrais is made by humans and manure is made by God. But I don't know the things in *engrais* to show other differences.

Engrais tubaku is strongest because the effect is very rapid. You apply it and you can see the difference, while manure is slow because it decomposes slowly.

Engrais is made by machines and it doesn't have everything that a plant needs while there are many things in the leaves and grasses that the animals eat.